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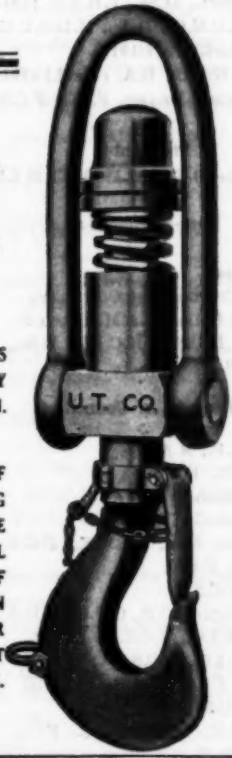

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Members are invited to submit papers to be read at the General Meetings of the Institution, and are specially asked to forward articles for publication in the Journal.

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Medal for Student Members. A medal and a prize of five guineas will be awarded annually by the Council to that Student Member of the Institution who shall, in their opinion, have presented a paper of outstanding merit during the session.

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Library. The Institution's Library may be consulted between the hours of 11 a.m. and 4 p.m. daily.

ADDITIONS TO THE LIBRARY SINCE LAST JOURNAL.

Geologic Structures. By Bailey Willis. 1st Edition, 1923.

Fuel. (Published by Colliery Guardian Co., Ltd.). Jan. to Nov., 1924.

From A. Hamilton Garner :—

Oil Geology of Northern Venezuela, 1924.

From National Supply Corporation :—

No 3. National Portable Drilling Rig.

From K. G. Mackenzie :—

Report of Committee D-2 on Petroleum Products and Lubricants, 1924, American Society for Testing Materials.

From Baird and Tatlock (London), Ltd. :—

The Testing of Bitumen and Tar for use in Road Paving and other work. Apparatus required for the Testing of Petroleum Products.

From University of Birmingham :—

Regulations and Syllabus. Faculty of Science. 1924–25.

From Empire Mining and Metallurgical Congress :—

Interim (abridged) Report of Proceedings, 1924.

From the Institution of Engineers, Australia :—

The Power Resources of the Commonwealth of Australia and the mandated Territory of New Guinea. Report to the World Power Conference, London, 1924.

From Institution of Automobile Engineers :—

Proceedings. Vol. XVIII. Part II. 1923–4.

From Lieut.-Colonel Sir A. T. Wilson :—

Researches of the Department of Terrestrial Magnetism. Vol. IV. Land Magnetic Observations, 1914–20. By L. A. Bauer, J. A. Fleming, H. W. Fisk and W. J. Peters. (Publication 175 of Carnegie Institute, Washington, U.S.A.)

From American Society for Testing Materials :—

A.S.T.M. Standards, 1924.

From Messrs. Edward Arnold and Co. (for Review) :—

Fuel Solid Liquid and Gaseous. By J. S. S. Brame. 1924.

From Messrs. Constable and Co., Ltd. (for Review) :—

"Gasoline and other Motor Fuels." By Carleton Ellis and Joseph V. Meigs. 1921.

From British Engineering Standards Association :—

B.S. Aircraft Material and Component Specifications, Publication No. 2. S.P. 4. Steel Pins. B.S. Specifications for Fuels for Heavy Oil Engines (Petroleum and Shale Oils), No. 209. 1924. B.S. Classification of Pure Mineral Lubricating Oils. No. 210. 1924.

From Imperial Mineral Resources Bureau :—

The Mineral Industry of the British Empire and Foreign Countries. Statistics, 1920–22. Lead and Zinc, Iron and Steel.

From U.S. Geological Survey. Department of the Interior :—

Professional Paper 127. The Composition of the Earth's Crust.

Petroleum in 1922. By G. B. Richardson.

Mineral Resources of the United States in 1923. Preliminary Summary.

Bulletin 758. Bibliography of North American Geology for 1921–22.

From The California Mining Bureau :—

"Petroleum Resources of California," with special reference to unproved areas. Bulletin 89. 1921.

From Department of Mines, Canada :—

Report of the Canadian Arctic Expedition, 1913–18. Vol. XI. Geology and Geography.

PERSONAL NOTES OF MEMBERS AND SPECIAL NOTICES.

It is suggested that members send information regarding their movements to the Secretary, for insertion under this heading.

Mr. T. G. Madgwick has gone on a trip to the Near East and is expected to be abroad for six months.

Mr. W. Graham has returned from Miri, Sarawak, and is now in England.

Mr. L. Owen has left for Cartagena, South America.

Mr. A. P. Faickney has now returned from Burma.

Lieutenant G. C. Flower, R.N.R., is now in England.

Mr. P. N. Koggerman has returned to Esthonia.

Mr. A. G. V. Berry is now in England.

Captain W. H. Cadman is on his way to Mohammerah, Persian Gulf.

Mr. V. Dvorkovitz has returned from Venezuela.

MR. F. G. RAPPOPORT has returned from Mesopotamia and Persia.

DR. J. A. L. HENDERSON sailed from Canada on December 14, and expects to arrive in England on or about December 22.

The Secretary will be glad to receive information as to the whereabouts of the following members: H. L. J. BUTLER, J. A. CHOWN, W. E. G. HUDSON-HOBDEN, ALBERT JEFFREYS, W. MURRAY-JONES, A. H. NOBLE, CARL PHILLIPS and A. E. YATES.

STANDARDISATION COMMITTEE.

The Report of the Standardisation Committee of the Institution has now been published under the title of "Standard Methods of Testing Petroleum and its Products," and copies can be obtained from the Institution Offices at the published price of 6s., or to members of the Institution for distribution, and marked "complimentary," at 4s.

SEVENTH ANNUAL DINNER.

The Seventh Annual Dinner of the Institution of Petroleum Technologists has been arranged to take place at the Connaught Rooms, Great Queen Street, London, W.C. 2, on March 17, 1925, and members are asked to make a note of the date.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

The Eighty-first General Meeting of the Institution of Petroleum Technologists was held at the Royal Society of Arts, on Tuesday evening, November 4th, 1924, Mr. Herbert Barringer, M.Inst.C.E., M.I.Mech.E., M.I.N.A., M.Inst.Mar.Eng., President, occupying the Chair.

The President, in opening the meeting, said that Mr. Campbell Hunter had very kindly offered to read a paper on "The Oilfields of Argentina." Very little had been published in reference to that matter and the Institution was much indebted to the author, who was very well qualified to speak on the subject, for writing the paper.

The following paper was then read :—

The Oilfields of Argentina.

By Campbell M. Hunter, O.B.E., M.A., A.M.Inst.C.E., F.G.S., F.R.G.S. (Member).

Historical.

Scientific attention was first directed to the oil possibilities of Argentina about 1885, when Stelzner made a geological investigation of the oil occurrences on the western slopes of the Sierra de Uspallata, close to Agua Zorra, Cacheuta, in the Province of Mendoza. Examination of the sedimentary formations with which these occurrences of oil were associated proved them to be of Rhætic age. In the following year drilling operations were commenced at Cacheuta, by the Compania Mendocina de Petroleo, under the direction of Dr. Zuber, who in 1890 published his first monograph on the district.

From 1890 to 1900 great interest was shown in the discovery and study of various oil and bitumen occurrences in the Andean foothills extending southward from Mendoza as far as the Province of Neuquen. The first important discovery was that of asphalt at the mines Eloisa y Roca, situated in the valley of the River Manga, one of the tributaries of the Rio Atuel. At first this substance was confused with that of coal, but the investigations by Dr. Zuber of the oil seepages at Cerro los Buitres and Cerro Alquitran dispelled this error. The formations responsible for these seepages were assigned originally to Rhætic age, and it was not until Bondenbender concluded his survey of oil indications as far south as Neuquen that it was recognised the formations belonged to Tithonian age.

Between 1896 and 1903 much geological work was carried out by Burckhardt, in the Territories of Neuquen and Rio Negro,

and the basis was laid of our present knowledge of the stratigraphy of the Jurassic and Cretaceous periods in the Argentine Cordillera.

Between 1905 and 1907 Ameghino, Wilckens and Haupt directed their attention to the geology and palæontology of various areas in this zone.

In 1908 and 1909 drilling operations were commenced in the Neuquen area at Cerro Lotena by the "Neuquen Oil Syndicate," also at Covunco by the "Acme Oil Syndicate." These operations proved abortive, mainly owing to transport difficulties, and were suspended before commercial results were obtained. About the same time an Argentine company, called "El Petroleo Argentina," was formed to undertake the development of the oilfields at Los Buitres and Cerro Alquitran, situated some 200 kilometres from the town of San Rafael. Unfortunately, this company located its wells where, according to the forecasts of Dr. Zuber, the chances of success were rather slender. In spite, however, of this disadvantage, oil of a heavy character was struck in several wells.

In 1909 drilling was resumed in the Cacheuta district by an English company, called the "Argentine Western Syndicate," which, in the following year, formed the "Cacheuta Oil Syndicate." Several wells were drilled by the new company, but, again, the production was not found sufficiently well maintained to make the venture a commercial success.

About the same time renewed attention was directed to the numerous oil indications in the Provinces of Salta and Jujuy, north Argentina, and in 1908 the author of this monograph made a detailed examination of certain oil occurrences at Aibal, not far distant from the station of El Quemado, in the Province of Jujuy. During the course of these investigations, the author discovered a very well-defined broad anticline exposed on the left bank of the Rio Negro, at the Barranca Tortugas, not far from the village of Canitas. A trial hand boring was started, but suspended after the author had left the district and before it had reached a depth of 150 feet. The existence of this structure was subsequently overlooked until it was rediscovered by Dr. Guido Bonarelli.

At Garrapatal, in the same district, a well had been drilled several years previously, under the direction of Dr. Zuber. But the results obtained were not sufficiently encouraging to warrant other wells being sunk. A similarly disappointing result followed the drilling of two wells at Laguna de la Brea by Elgin Scott about 1909.

While desultory prospecting operations for oil had thus taken place since 1885, the first important strike of oil did not occur till 1907, when a well originally designed for obtaining fresh water struck oil in considerable quantity at Comodoro Rivadavia, in the State of Chubut, at a depth of 535 metres. The fortuitous

discovery of oil in this well is well known, but bears repeating, since it illustrates again how great events may owe their existence to mere chance. Owing to the absence of fresh water at the small fishing port of Comodoro Rivadavia, the Government undertook to drill a well. Although it soon became evident no fresh water was likely to be encountered—in fact the well stood full of salt water—drilling operations were continued, with a view to affording useful geological information as to the sub-strata in that portion of Patagonia. On attaining a depth of 500 metres, the engineer in charge asked for further instructions, but before these were received to the effect that operations were to be suspended and the rig dismantled, oil was struck at 535 metres, the well flowing strongly. With this happy outcome the modern history of the oil industry may be said to commence.

Encouraged by the success obtained at Comodoro Rivadavia, the Argentine Government started prospecting operations at Plaza Huincul, in the Territory of Neuquen, about 1917. The first well was completed in September, 1918, at 610 metres, at which depth it flowed strongly.

Geological.

Before describing the various oilfields in detail, a brief survey of the structure of Argentina will enable a better understanding to be obtained of the geological conditions which obtain on the various oilfields.

In Palæozoic times the present continent of South America formed part of the Brazil-Ethiopian Continent, Gondwana, which extended from South America to Africa. According to Dr. Windhausen, the western side of this old Continent was flanked by a great geosyncline, which in Tertiary times gave rise to the present Andean range. The Jurassic and Cretaceous sediments of this syncline are found extending in a great fan over Argentina, commencing in the north in the region of the Rio de los Patos, to the north of Aconcagua, and extending southward to Tierra del Fuego. The history of this geosyncline in Jurassic and Cretaceous times was associated with numerous oscillations along the coast-line, transgressions and regressions following each other in frequent succession. On the base of the porphyrites and granites of probably Palæozoic and Triassic age are found the conglomerates of the Triassic transgressions, followed upwards by Lias and Dogger sediments, whose faunal contents bear considerable resemblance to corresponding European types. A new transgression began in Kimmeridge-Tithonian times, the tendency towards the deepening of the geosyncline continuing until the middle of the Cretaceous epoch. The most remarkable phenomenon of this second marine

transgression is the faunal and petrographic uniformity which is rarely equalled elsewhere. Thus, the Kimmeridge and Tithonian beds are found in Neuquen with the same characteristics as in the region of Aconcagua, these beds as well as the Neocomian being specially characterised by great abundance of types, species and individuals. As in other parts of the world, the marine fauna attained during this epoch the height of its development in the Sub-Andean period. Above the Neocomian marine deposits lie the "Variegated Sandstone series" which here represent the Upper Cretaceous. These sandstones correspond with periods of regression of the sea towards the Pacific and represent a period of mainly continental conditions. Towards the end of this period the orogenetic movements commenced during which the great Andean fold along the coast of the Brazil-Ethiopian Continent was formed.

Such, in broad outline, is the history of the Andean Mesozoic geosyncline, which subsequently was subjected to tectonic movements.

Oil Indications.

From the extreme south to the extreme north of the Argentine Republic, innumerable indications of oil, asphalt, rafaelite, etc., occur. Thus heavy oil is found seeping out near Punta Arenas, on the Straits of Magellan, in beds assigned to the Tertiary period, but so far no systematic prospecting operations have been carried out. The most southernly wells drilled in search of oil are in the neighbourhood of Santa Cruz, but the results so far recorded are of a discouraging order. From Comodoro Rivadavia the oil belt extends northwards through the territory of Neuquen and the Provinces of Mendoza, Salta and Jujuy, to the Bolivian frontier. The distance represented by this long succession of oil indications is about 2500 kilometres (1500 miles), the width being at present unknown. (See Fig. 1.)

Broadly, the oil-bearing formations now exploited in the Argentine belong to the Cretaceous at Comodoro Rivadavia, the Upper Jurassic in the Province of Neuquen, the Triassic (Rhaetic) at Mendoza and range from Upper Mesozoic to the Devonian in Jujuy and Salta.

Comodoro Rivadavia.

Dealing with the various oilfields in their order of importance, those of Comodoro Rivadavia claim first attention. As stated above, this field was first discovered by a happy chance on December 13, 1907, when oil was struck at a depth of 535 metres. Immediately upon oil being struck the Government suspended the

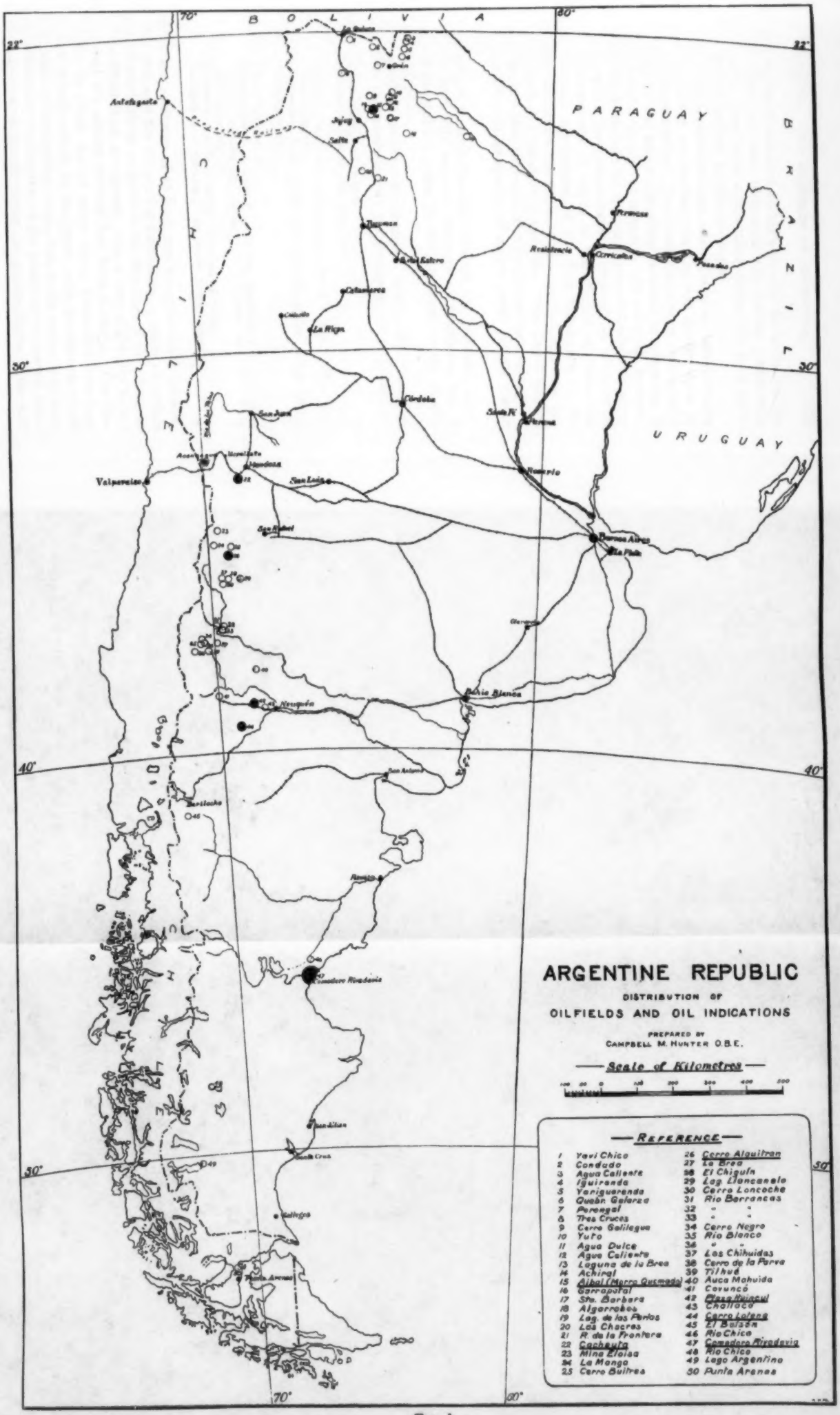
ARGENTINE REPUBLIC
DISTRIBUTION OF
OILFIELDS AND OIL INDICATIONS
PREPARED BY
CAMPBELL M. HUNTER O.B.E.
Scale of Kilometres
REFERENCE
1 Yavi Chico
2 Condado
3 Agua Caliente
4 Iguiranda
5 Yariguaranda
6 Quebr. Galarza
7 Perengal
8 Tres Cruces
9 Cerro Golilegua
10 Yuto
11 Agua Dulce
12 Agua Caliente
13 Laguna de la Brea
14 Achiral
15 Aibal (Morro Quemado)
16 Garrapatal
17 Sta. Barbara
18 Algarrobos
19 Lag. de las Perlas
20 Los Chacras
21 R. de la Frontera
22 Cachauta
23 Mina Eloisa
24 La Manga
25 Cerro Buitres
26 Cerro Alquitran
27 La Brea
28 El Chiguin
29 Lag. Llancanelo
30 Cerro Loncoche
31 Rio Barrancas
32 " "
33 " "
34 Cerro Negro
35 Rio Blanco
36 " "
37 Las Chihuidas
38 Cerro de la Parva
39 Tilhue
40 Auca Mahuida
41 Covunco
42 Plaza Huincul
43 Challaco
44 Cerro Lotena
45 El Buitron
46 Rio Chico
47 Comodoro Rivadavia
48 Rio Chico
49 Lago Argentino
50 Punta Arenas
BOLIVIA
PARAGUAY
URUGUAY
CHILE
ANDES
70°
60°
22°
30°
40°
50°

FIG. 1.

Mining Laws within a radius of 25 kilometres of the well, and the Mining Department at once undertook the further prospecting of the new field. Five wells were drilled during the next three years, all of which yielded petroleum or gas.

In 1910 the Government reserve was reduced to 5000 hectares (12,500 acres) and the surrounding country was thrown open to public and private enterprise. Numerous concessions were applied for, but, owing to the many difficulties incident to operating in the locality, several were allowed to expire. It was soon, however, apparent that much undesirable speculation in oil lands was taking place, to stop which the Government prohibited, by a decree in 1913, the denouncement of mines in the district of Comodoro Rivadavia, between the parallel of the Pico Salamanca on the north and parallel 46 on the south, and a north and south line 30 kilometres west of Comodoro Rivadavia. This decree applied only to fiscal lands within that area, and thus permitted the acquisition by prospective oil companies of a few small private tracts. (See Fig. 2.)

More recently the Argentine Government has reframed many of the mining laws with especial reference to petroleum, but as the new laws are still *sub judice* further comment would, at this stage, be out of place.

The geological formations encountered within the Comodoro Rivadavia area, commencing with the youngest, are as follows:—

Quaternary.	Tehuelchean pebble beds. Araucanian sandstones, clays, etc.
Tertiary.	Marine Patagonian formations (sand, clays, tuffs, etc.). Unconformity. Mammalian beds (white and greenish-yellow sandy clays). Unconformity.
Cretaceous.	Upper Cretaceous. Salamanquean (Danian) formation (greenish-red and black clays) containing upper oil horizon at the base. Unconformity (?). Senonian (grey-blue sandy clays and oil sands). Variegated Sandstones ("Areniscas Abigarradas").

Owing to the existence of at least two unconformities between the surface beds and the oil-bearing formations, a study of surface exposures affords little or no guide to the structure of the oil series. Actually the formations, as exposed, have a very slight dip to the south-east and are almost entirely free from faulting. The Cretaceous beds, in which the oil series occur, have doubtless been affected to a certain extent by the great earth movements which caused the uplift of the Andean range, but, in the author's opinion, the most satisfactory explanation of the numerous elongated structures which have been traced within the proven limits of the field

is to be found in erosional conditions that would be present at the mouth of a great delta, followed by a phase of more or less rapid submersion or depression, during which the invading sea, here represented by the fossil deposits of the zone of Lahillia Luisa, covered the deltaic channels and sandbanks.

FIG. 2.

The present area over which oil prospecting operations have been conducted extends from Mangrullo, some 40 kilometres (24 miles) to the south-west of Comodoro Rivadavia to Puerto Visser, some 60 kilometres (36 miles) to the north-east, or in all

FIG. 3.

GOVERNMENT WELL NO. 128, COMODORO RIVADARIA

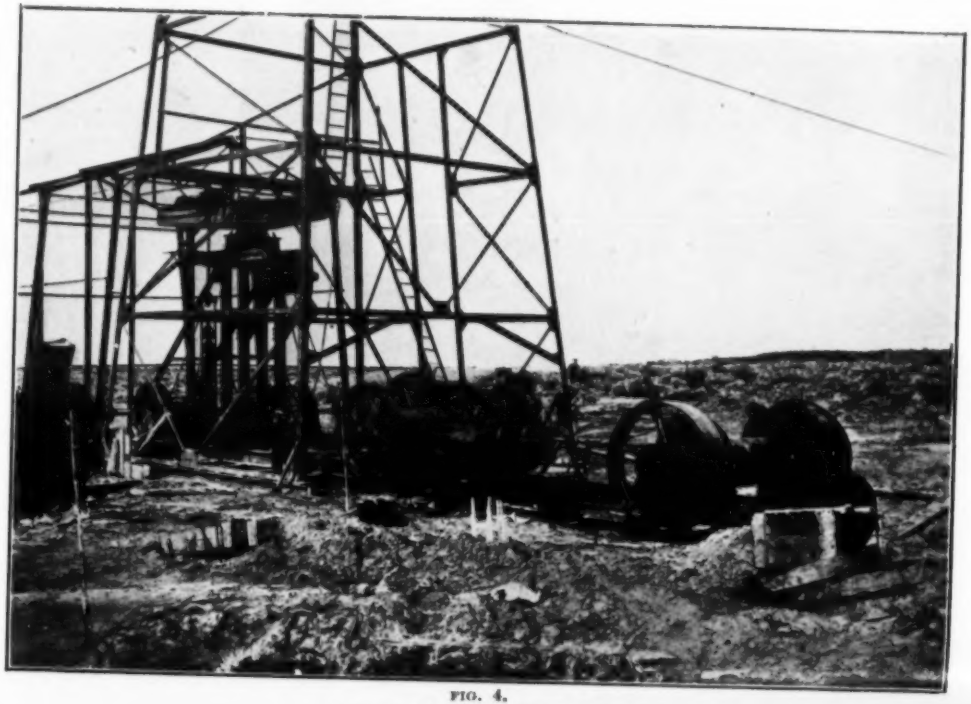

FIG. 4.

A FAUCK-EXPRESS DRILLING RIG.

over a roughly north and south distance of 100 kilometres (60 miles). The wells at Mangrullo have not yet been drilled in, so the definite presence of oil in that area remains to be proven. The results at Puerto Visser were negative, though oil indications were encountered. Actually the present area over which oil has been encountered in greater or less quantity in the Commodoro Rivadavia Field is represented by Well No. 99 of the Government in the south, and Kinkelin Well No. 1, not far from Pico Salamanca in the north, representing roughly a north and south distance of 32 kilometres (19 miles), with an at present maximum east and west extension of approximately 10 kilometres (6 miles), or in all say 160 square kilometres or 60 square miles.

FIG. 4.
A FAUCK-EXPRESS DRILLING RIG.

Various drilling systems are in use on the Comodoro Rivadavia Field. The Government have until recently relied almost exclusively on the Fauck Express System. A few Canadian rigs, some with pole, others with wire cable tools, have been used, and good results have been obtained by combining Canadian rigs with the use of hollow water-flush rods. The Astra Company, which is an Argentine concern, relies on the Raky system. Although the Rotary had been tried and rejected as utterly unsuitable, the author was convinced that the formations, at all events down to a depth of about 450-500 metres, were ideal for rotary drilling, and determined to give that system another trial under more workmanlike conditions. The results obtained were, from the outset, very striking. Thus, while the average time taken to drill wells with other systems exceeded twelve months, the average time occupied by the rotary alone or the rotary combined with hollow rods, amounted to only 60 days. Trial was made with cable tools for drilling-in, but owing to the heavy nature of the oil and the plastic condition of the clays and shales, the tools would not fall freely and the trial was a failure. The combination of hollow rods, worked off a local American type walking-beam, was found to give excellent results, especially as by using a reverse flush a continuous succession of good samples can be obtained. The importance of this latter feature cannot be over-emphasized, as the formations in most parts of the field are so thin and lenticular that, unless great care is exercised, serious damage may result by inadvertently drilling through an oil sand into underlying water-bearing strata.

Until recently the methods adopted for exploiting the wells were confined to swabbing or bailing. The author was among the first to introduce the multiple pumping system, which has enabled the cost of production to be greatly reduced. Interesting experiments are now being conducted with gas jets, but results so far obtained are inconclusive.

The importance and magnitude of the Comodoro Rivadavia Field is well illustrated by the following production figures:—

PRODUCTION OF THE COMODORO RIVADAVIA OILFIELD.

Year.	Explotacion Nacional.	Cia. "Astra."	Cia. Argentina.	Synd. de Perforaciones.	Total Production.
	Cubic Metres.	Cubic Metres.	Cubic Metres.	Cubic Metres.	Cubic Metres.
1907	16	—	—	—	16
1908	1,821	—	—	—	1,821
1909	2,989	—	—	—	2,989
1910	3,293	—	—	—	3,293
1911	2,082	—	—	—	2,082
1912	7,461	—	—	—	7,461
1913	20,733	—	—	—	20,733
1914	43,795	—	—	—	43,795
1915	81,580	—	—	—	81,580
1916	129,890	6,915	1,016	—	137,821
1917	181,629	6,810	5,236	—	193,675
1918	197,574	7,765	7,746	—	213,085
1919	188,093	16,888	5,943	—	210,924
1920	226,545	22,014	9,950	3,728	262,237
1921	276,808	31,222	12,992*	1,791	322,813
1922	343,910	74,701	26,613	1,235	446,459
1923	408,139	80,224	35,714	3,552	527,629
	2,116,358	246,539	105,210	10,306	2,478,413

According to latest advices, the present combined production of the whole field is at the rate of about 750,000 tons a year, and, as it is the intention of the Argentine Government to greatly intensify its drilling programme, there is reason to anticipate that it will not be long before the field is producing a round million tons per annum.

The oil produced at Comodoro Rivadavia is essentially of the fuel oil type, an average analysis being as follows:—

Specific gravity at 15° C.	0·912
Viscosity at 15° C.	21·15
Flash point	22° C.
Calorific value	10,000 to 10,200 calories
Distillation—commences at	75° C.
Products distilling over up to 150° C.	4·5%
Products distilling over from 150° C.—300° C.	18·5%
Products distilling over above 300° C.	77·0%

The bulk of the production is shipped in its crude state to Buenos Aires and Bahia Blanca, where it is used as fuel, though a small quantity, amounting in 1923 to 43,062 tons, was passed through the Government Refinery at Comodoro Rivadavia.

Recently the Direccion General de Yacimientos Petroliferos Fiscales was granted a credit of $20,000,000 m/n (£1,750,000) for the purpose of erecting a large Refinery at La Plata, with an estimated daily throughput capacity of 2000 tons, and for the

* From 1921 inclusive operated by Cia. Ferrocarrilera de Petroleo.

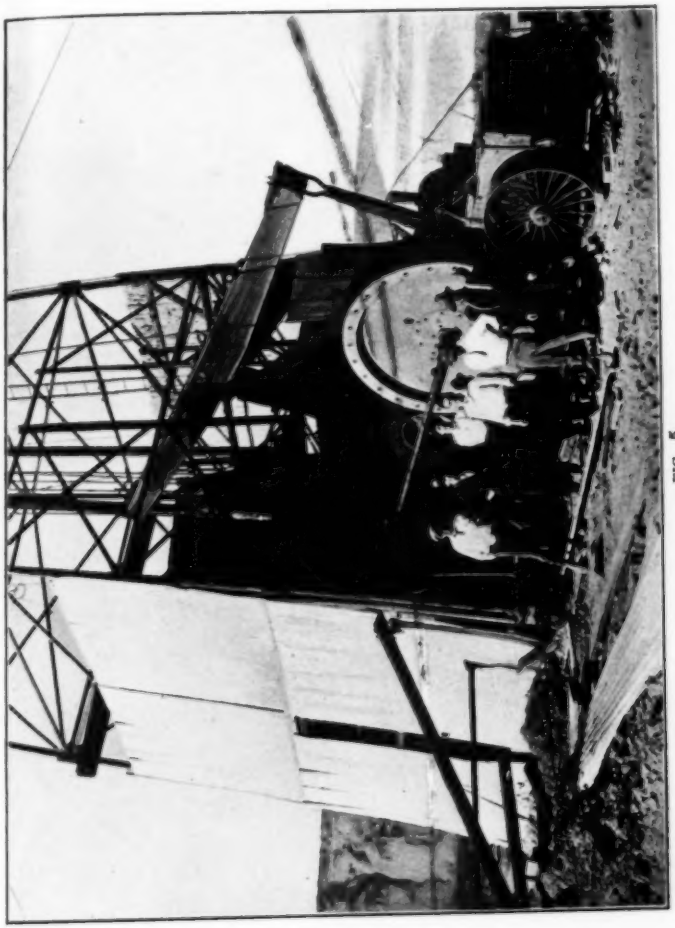

FIG. 5.
COMBINATION ROTARY—STAR AND HOLLOW ROD RIG

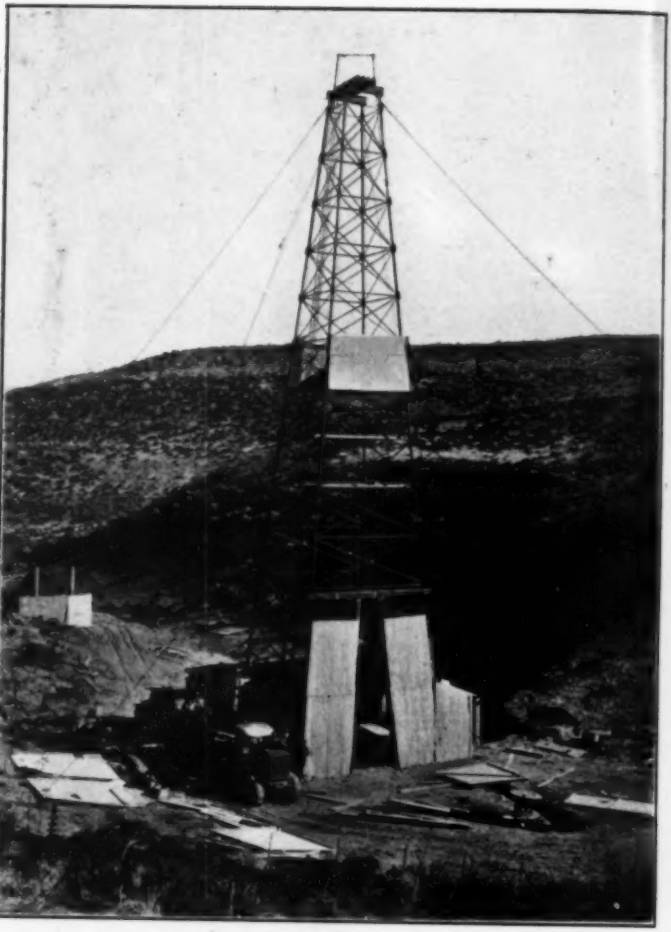

FIG. 6.

TUBULAR STEEL DERRICK, NORTH EXTENSION COMODORO RIVADARIA FIELD.

FIG. 7.

ELGIN SCOTT WELL.

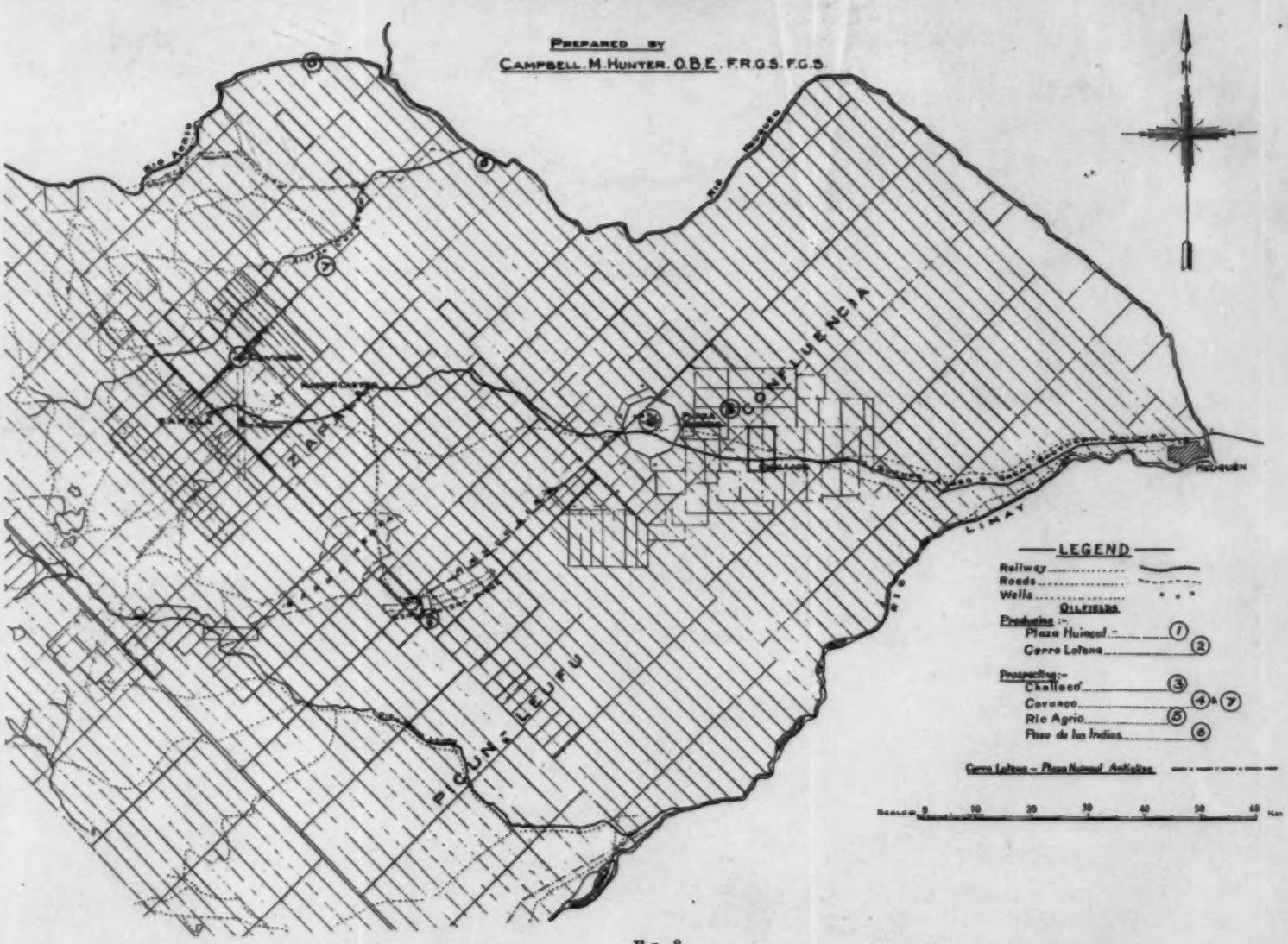
— PLAN OF THE NEUQUEN OIL FIELDS —
PREPARED BY
CAMPBELL. M. HUNTER. O.B.E. F.R.G.S. F.G.S.
N
CONFLUENCIA
NEUQUEN
LIMAY
PICUN-LEUFU
LEGEND
Railway
Roads
Wells
OIL FIELDS
Producing :-
Plaza Huincul (1)
Cerro Lotena (2)
Prospecting :-
Challaco (3)
Covunco (4 & 7)
Rio Agrio (5)
Paso de los Indios (6)
Cerro Lotena – Plaza Huincul Anticline
SCALE 0 10 20 30 40 50 60 Km

FIG. 8.

further intensive development of the various national oilfields. There is, therefore, every evidence that the Argentine Government intend to actively develop the oil resources of Argentina as a whole, and of Comodoro Rivadavia in particular.

One of the difficulties attending the exploitation of the oilfields at Comodoro Rivadavia is the presence of salt water in the oil bearing formations. Owing to the very lenticular nature of the oil series and the close proximity of highly saturated water sands, it is often found that, apart from the main water shut-off cementation at about 450 metres, further cementations are required to exclude secondary water sands, which occur both above and below the oil sand lenticles. These operations necessarily add considerably to the actual time taken for drilling the well, and call for the exercise of careful supervision on the part of the technical staff. In the author's opinion, much trouble has been caused through allowing wells to flow at a rate in excess of that consistent with the maintenance of a fair equilibrium between the static and dynamic conditions present in the oil sand. The result of neglecting this important point has been the premature flooding of wells and the consequent admission of water into the oil sands exploited by adjacent wells.

Neuquen Oilfields.

The next most important oil-bearing area in Argentina is undoubtedly that associated with the name of the Province of Neuquen. As previously stated, the geological conditions under which oil is found in this area are entirely different from those present at Comodoro Rivadavia. Within this zone, which extends roughly from at least Bariloche in the south to Cerro Alquitran, Los Buitres and to the Mines of Eloisa and Roca in the north, the oil-bearing series forms part of the Upper Jurassic system. (See Fig. 8.)

Possibly one of the best exposures of this Upper Jurassic Oil Series is found on the southern flank of Cerro Lotena, close to where drilling operations were undertaken by Argentine Oilfields, Limited. The geological sequence of beds exposed there is as follows :—

Upper Cretaceous	..	Variegated Sandstones (Candalero group).
		Unconformity.
Lower Cretaceous	..	Neocomian. (?)
		Neocomian.
Upper Jurassic	..	Tithonian.
		Kimmeridge Portland (oil-bearing).
		Unconformity.
		Lower Kimmeridge. (?)
		etc.

The structure of the formations in the Cerro Lotena-Plaza Huincul area is interesting, and shows very clearly the influence of

different tectonic movements. Briefly, these may be chronologically arranged as follows:—

1. The main Jurassic movement which caused the principal uplift of the Cerro Lotena range during Kimmeridge times, but anterior to the deposition of the Kimmeridge-Portland (?) oil-bearing series, which here lie with marked unconformity upon the lower Kimmeridge (?) Terrestrial Grits and Sandstones. (See Fig. 9.)
2. A movement which took place in Middle Cretaceous times, but subsequent to the Neocomian period, and which resulted in the Candalero members of the Lower Variegated Sandstone Series (Upper Cretaceous) lying unconformably on the Neocomian and other lower formations. This remarkable unconformity is admirably exposed close to the oil seepage at Cerro Lotena, and gave rise to a curious misinterpretation of the upper beds, which were at one time erroneously ascribed to the Roca or early Tertiary Series. (See Fig. 10.)
3. A more gentle movement towards the end of the Cretaceous or early Tertiary times, and as such reflecting the fading out of the great tectonic movements which were responsible for the final uplifting of the Andean Range.

The directions of the pressures which gave rise to these movements have been along different axes. Thus, the earliest movement, namely, that in Jurassic times, undoubtedly proceeded from the north-west, and gave rise to the north-east and south-west folding of the older Jurassic rocks. The tectonic movements which occurred in Middle Cretaceous times were probably also from the same direction, whilst those reflected in the Upper Cretaceous formations resulted in flexures running approximately east and west.

A study of the drainage system of the Neuquen area lends strong support to the contention that the main lines of flexure, consequently zones most favourable to the accumulation of oil, run south-west and north-east. Against this may be cited the views of Dr. Keidel, on whose advice the first well at Plaza Huincul was located. This site was selected to strike the oil-bearing series, which was there supposed to conform with an east and west anticlinal, clearly developed in the middle and upper Variegated Sandstone Series. In the author's opinion, the fact that oil was struck at Plaza Huincul is a further instance of exceeding good fortune attending the Government's prospecting operations, since he considers the structure of the oil series at Plaza Huincul conforms with an extension of the anticline clearly exposed at Cerro Lotena trending in a north-easterly direction. Only further drilling will

FIG. 9.

LOWER UNCONFORMITY, CERRO LOTENA.

FIG. 10.

MIDDLE UNCONFORMITY, CERRO LOTENA.

FIG. 11.

VIEW OF GOVERNMENT RESERVE, PLAZA HUINCUL

establish which of these two views is correct, though the weight of evidence at present supports the author's contention that the minor foldings present in the Upper Cretaceous formations do not extend to any great depth, certainly not to such depth as would influence the accumulation of oil present in Upper Jurassic strata.

Apart from early desultory prospecting operations which took place about 1907–1908 at Covunco and Cerro Lotena, the first commercial oil well to be drilled in this area was completed by the Argentine Government at Plaza Huincul on September 30, 1918. This well flowed initially at the rate of several tons a day, the oil being of remarkably high grade, with an analysis as follows:—

Sp. gravity at 22·5	0·8423
Calorific value	11,000 Calories.
Sulphur	0·11%
Paraffin	2·9%
Asphalt	9·11%
Viscosity at 20%	3°·2 Engler.
Flash point	− 3° Centigrade.
Ash	0·0101%
Water	Nil.
Products distilling over up to 150°, *i.e.*, petrol	24·4%
Products distilling over from 150° to 300° Centigrade, *i.e.*, kerosene	38·5%

Immediately on striking oil the Government decided to drill further wells, the nett result of which has, on the whole, been very satisfactory. Owing to the inland situation of Plaza Huincul, and to the circumstance that the oil was so high grade as to render it unsuitable for immediate consumption as liquid fuel, the Government preferred to concentrate its operations on the more southern coastal field of Comodoro Rivadavia, where incidentally higher initial productions were being obtained.

Since the completion of the Discovery well at Plaza Huincul, some 17 wells have been drilled on the Government Reserve. But the production returns afford no reliable indication of the capacity of the field, since for years the wells were not exploited once they ceased flowing, and it is only recently that systematic pumping has been instituted. (See Fig. 11.)

Production from the Government Reserve at Plaza Huincul.

1921	918 cubic metres.
1922	4,987 „ „
1923	6,899 „ „

Encouraged by the success of the Government at Plaza Huincul, and no doubt basing their views largely on published geological reports by the Government, all of which indicated the Plaza Huincul Anticline as trending east and west, several private enterprises acquired concessions to the eastward of the Government Reserve. The outcome of these ventures has so far been unsatis-

factory. More recently, drilling operations were initiated by Argentine Oilfields Limited on the southern flanks of Cerro Lotena, where high grade oil has been encountered in several wells, and the prospects of opening up commercial production appear assured.

The most interesting well recently drilled in the Plaza Huincul district lies immediately to the westward of the Government Reserve, and was sunk by the Cia. Petroleo de Challaco. Oil was struck at 712 metres, at which depth the well flowed from 30 to 50 tons a day, the quality of the oil being similar to that encountered on the Government Reserve. (See Fig. 12.)

Apart from the operations which have already taken place in the Cerro-Lotena-Plaza Huincul area, the author is of the opinion that the Jurassic Oilfields of Argentina promise to play an increasingly important rôle in the oil industry of that country. In the first place, the area over which the Jurassic oil-bearing series occurs is very considerable, exceeding probably 800 kilometres (500 miles) in a north and south direction, while its easterly extension is at present undetermined. Taking into account the thickness of this Jurassic Oil Series, its great extent, the numerous favourable geological structures which are exposed, and of which, doubtless, many more exist but are not reflected on the surface, and bearing in mind the high quality of the oil produced, it is reasonable to venture the opinion that this area is destined to figure prominently in the future.

Auca Mahuida.

Before passing from the oilfields of the Neuquen district to those near Mendoza, reference must be made to the very important seams of Rafaelite which are found to the south-east of the old extinct volcano, Auca Mahuida. Two thick veins of this high grade asphaltite have been found in this area. These veins cross the valley in a north north-west and south south-east direction, and coincide with the crests of two gentle anticlines, which doubtless owe their origin to the movements associated with the volcanic upheaval that was responsible for the lava flow of Auca Mahuida. According to Dr. Pedro T. Vignau, the Auca Mahuida Rafaelite possesses the following characteristics:—

	Sample from surface.	Sample at depth 5 metres.	Sample at depth 23 metres.
Density	1·1405	1·1406	1·1041
Fracture	conchoidal	conchoidal	conchoidal
Volatile substances	56·85	62·425	65·725
Fixed carbon	42·55	37·387	33·975
Ash	0·598	0·2875	0·293
Sulphur	5·3592	3·005	3·062
Nitrogen	0·9877	1·113	1·2705

FIG. 12.

SOL WELL, PLAZA HUINCUL.

FIG. 14.

DISCOVERY WELL, MORRO QUEMADO (HUNTER) ANTICLINE.

In general appearance this Rafaelite resembles very closely the asphaltites known as Manjac in Barbados and Grahamite in the United States, and is undoubtedly derived from petroleum having a paraffin base. This conclusion corresponds with what one would expect from the geology of the district, and furnishes undoubted evidence of the extension of the Kimmeridge-Portland sea to the region that, to-day, is occupied by the cone of Cerro Auca Mahuida.

Cerro Alquitran.

The oilfield of Cerro Alquitran is situated about 200 kilometres (120 miles) westward of the township of San Rafael, in the province of Mendoza. The valley in which oil seepages occur is about 5 kilometres (3 miles) long and 1½ kilometres (1 mile) wide, and runs roughly north and south. To the southward the valley opens out, and in the centre of it lies the andesite rock mass of Cerro Alquitran. Two or three kilometres further to the south the valley again narrows and continues as such until it opens on to the Sub-Andean Plain. The trough-like configuration of the country to the west of the valley of Cerro Alquitran is due to alternating soft nad hard beds in the geological formation, the dip of which has a general trend to the westward. The origin of the oil is attributed to beds of Upper Jurassic age, which would correspond with the Kimmeridge-Portland oil-bearing series at Plaza Huincul and Cerro Lotena. Structurally, the field is somewhat complex, owing to the andesite rock mass of Cerro Alquitran having been thrust up through the oil series, which have, therefore, at the point of contact undergone partial distillation. This phenomenon is illustrated in a most interesting way by the occurrence of seepages high up the sides of Cerro Alquitran, and which can only owe their presence to inspissation through fissures, etc., into the andesite rock mass. Apart from this local structural phenomenon, the field represents a monocline dipping to the westward.

Mendoza.

While historically the Cacheuta oilfield, near Mendoza, is the oldest exploited field in the Argentine Republic, drilling operations, on the whole, have not been rewarded with the measure of success to which they were entitled. The earliest wells were located by Dr. Zuber close to the point of outcrop between the Rhætic beds and the great andesite rock mass forming the core of the Cerro de Cacheuta. Most, if not all, of the wells struck oil, several in considerable quantity. This initial success led to the construction of a 4-inch pipe-line to the station of San Vincente, a distance of about 30 kilometres from the field. For reasons attributed to the sudden exhaustion of the wells, the field was subsequently abandoned, but from time to time drilling operations were resumed,

FIG. 14.
DISCOVERY WELL, MORRO QUEMADO (HUNTER) ANTICLINE.

until finally in 1914–15 two wells were drilled on the plain, some distance away from the older and shallower wells. Of these the "Victor" is reported to have struck oil in considerable quantity at a depth of 997 metres, and according to local accounts is said to have flowed at the rate of from 50–100 tons per diem. The second well, "Guillermo," was stopped at a depth of 500 metres, owing, it is said, to the difficulty of obtaining drilling materials during the war.

The quality of the oil is excellent, and contains a considerable quantity of paraffin wax, while its constituents of petrol and kerosene appear in excess of that contained by average petroleum.

Geologically, and on a large scale, the field represents a fan-shaped monocline, the general dip being southerly. Within this area at least one structure merits attention.

Considerable interest attaches to the thick layer of finely laminated black shale, which overlies the first oil-bearing sandstone. This shale bed is about 60 feet thick, and from its appearance and texture is likely to be found to yield a considerable quantity of shale oil. In recent times attempts have been made to treat this shale, but results, although understood to be very satisfactory, have not yet been published.

Salta-Jujuy.

In the extreme north of Argentina, and bordering on Bolivia, occur a series of interesting flexures, which have been the subject of careful investigation by many geologists, such as Dr. Brackebusch, Dr. Stappenbeck, Dr. Schiller, Dr. Keidel and Dr. Guido Bonarelli. Briefly, these structures occur in what Dr. Bonarelli describes as the Sub-Andean system, which lies between two very different types of structure—namely, the horizontal one of the Chaco on the east and the very complicated system of the Eastern Andean Cordillera on the west. Speaking generally, the structures have a north and south Axis, and are the result of the pressure of a unilateral thrust from the west. Proceeding eastwards the folds show a gradual diminution in intensity, until the plains of the Chaco region are reached, where they are visible as only very gentle undulations, partly covered by Quaternary sediments. Owing to the widespread nature of the oil indications in this area, doubt still exists as to the primary source of the oil. Many of the formations exposed are clearly of continental origin, being devoid of fossils or other organic remains which would account for the origin of the oil.

The following diagram shows the various interpretations which have been given to the formations which outcrop within this region. The difference in the classifications is no doubt largely accounted for by the observers having recorded the formations

s exposed in different districts, and their endeavour to try to correlate as a whole the various formations examined.

Bonarelli. Sub-Andean System.		Madgwick & Romanes S.E. Bolivia.		Keidel Salta-Jujuy.	
Terciario Pleno pr. d.					
Terciario Subandino		Upper Sacarigua beds		Areniscas superiores.	
Areniscas sup.	Mesozoico Superior	(Sandst.) Lower Sacarigua beds	Sacarigua Inferior	Cal. litog	Cretacico
Margas verdes				Areniscas inf. Margas	
Horizonte calcareo dolomitico		(Limest.) Lower Sacarigua beds		Horizonte cal. con. Melania	
Areniscas Inferiores (Permotrias)		(Sandst.)		Conglom. de base	
		Mandiyuti beds		Silurico / Carbonico / Pericambrico	
Devonico.		Sararenda beds			

Within this Sub-Andean region numerous anticlines have been traced, mostly with overturned eastern flanks, while others have double axes (See Fig. 13). Of these, according to Dr. Bonarelli, the Morro Quemado (Hunter) dome is the only structure in the province of Jujuy presenting the conditions generally accepted as indispensable for justifying exploratory drilling. This structure is very regular and the dips are gentle on both sides, furthermore the Tertiary series has been deeply eroded along the crest, thus diminishing the thickness of the barren series which must be traversed by wells in order to reach the petroliferous beds. In 1922 drilling operations were initiated on this anticline by the State Railways Department of Argentina, and oil was struck in the first well in dolomitic limestone at a depth of 530 metres (1750 feet). (See Fig. 14). According to Dr. Longobardi, the oil has the following characteristics :—

Colour	Black.
Sp. gravity	0·960
Viscosity at 50° C. (Engler)	350·6
Calorific value	10,719 calories.
Sulphur	0·527%
Water	4·90%
By distillation up to 175° C.	3·40%
„ „ 175° C. to 300° C.	12·00%
„ „ 300° C. to 360° C.	17·00%
Residuum	62·70%

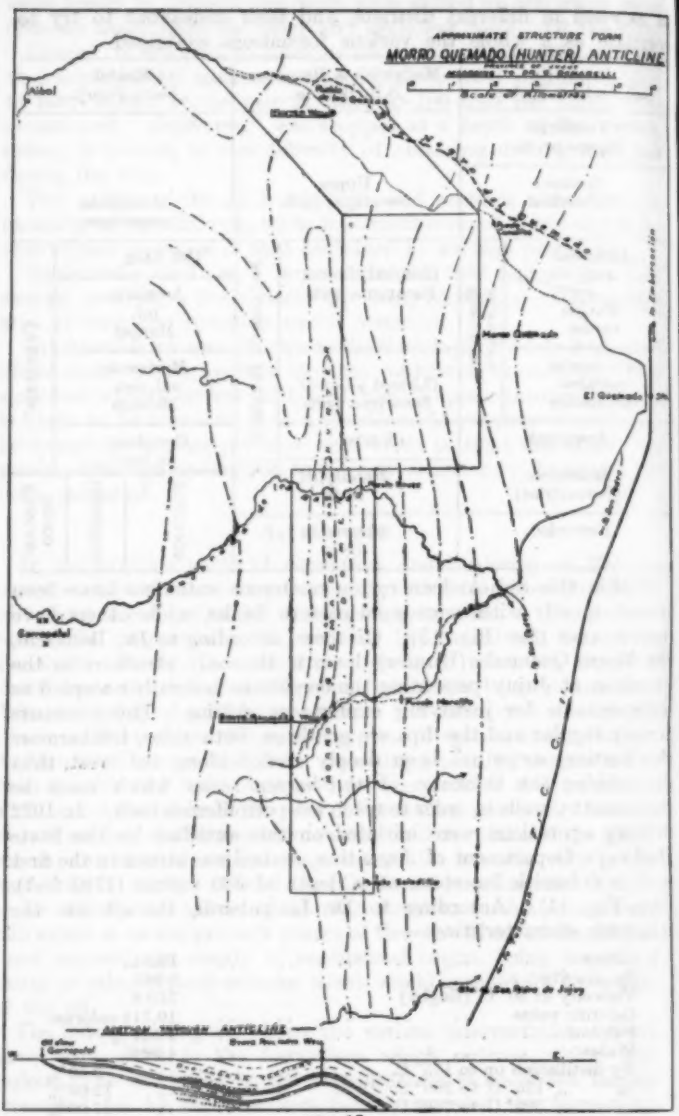
APPROXIMATE STRUCTURE FORM
MORRO QUEMADO (HUNTER) ANTICLINE
ACCORDING TO DR. E. BOMBERGER
SCALE OF KILOMETRES
Aibal
Morro Quemado
El Quemado
Campamento
ANTICLINE

FIG. 13.

According to Dr. Longobardi, the origin of the oil encountered in the Salta-Jujuy district may be assigned either to the dolomitic limestone (Upper Mesozoic) or to the Devonian.

In view of the great interest taken in the oilfields of Southern Bolivia by the Standard Oil Company, and that company's reported desire to extend its operations southward into northern Argentina, it is likely that this northern field of the Argentine Republic will furnish interesting results before long.

Conclusions.

From the foregoing necessarily brief survey of the potential oilfields of Argentina, it will be seen that the prospects of developing an important oil industry in that country are more than promising. Hitherto, attention has been chiefly directed to the southern coastal fields—namely, those at Comodoro Rivadavia, where, within the brief space of seventeen years, an annual production at the rate of about three-quarters of a million tons has been built up. Now, however, increasing regard is being paid to the other and higher grade oilfields of Argentina, notably those in the district of Neuquen. There, as in other parts of the Republic, numerous favourable geological structures are found, which in the author's opinion are destined to play an increasingly important part in the economic future of the country.

In the preparation of this paper liberal use has been made of the numerous bulletins published by the Argentine Government, to whom the author is further greatly indebted for the assistance it has so generously and freely accorded him during his several visits to Argentina. Grateful recognition is also gladly rendered to the local managements of the various companies for their productions and other data, and, last but not least, to Mr. R. H. Mitchell for his collaboration over geological problems and preparation of the various plans and well logs.

DISCUSSION.

The President said he was sure all present had been very much interested in the paper, which formed a very valuable addition to the proceedings of the Institution, especially, as he had previously mentioned, so little had been published in reference to the part of the world with which the paper dealt. No doubt there were many gentlemen present who knew Argentina, and the audience would be much interested to hear any remarks they had to make. He had no doubt, also, that the geologists present must have been much interested in the paper and would desire to discuss it.

Mr. T. G. Madgwick, in opening the discussion, commented on the great area embraced by the oil indications in Argentina,

where, although one or two areas had been investigated in detail, the bulk of the country was comparatively unknown geologically, and, consequently, it was previous to attempt much generalisation as to the manner of oil occurrence. He thought, however, apart from Comodoro Rivadavia and the extreme south, the known occurrences might be grouped in two areas, that of Neuquen and Mendoza in the centre and that of the Sub-Andean district in the north. Between the latter and the Pre-Cordillera, and penetrating in a wedge-shaped form northward into Bolivia, as far as the valley of the Pilcomayo, lies a block fault known as the Puna. The Neuquen-Mendoza area lies on the southern continuation of this fault block in the fan of Jurassic and Cretaceous rocks to which Mr. Hunter refers. The occurrence of oil appears to be here related to large Tertiary volcanoes, from which both basalts and andesites have flowed and near which occur veins of "Rafaelite," an asphaltite resembling Gilsonite. The number of these veins is said to be innumerable, and doubtless represents the more intense action of heated volcanic waters upon bituminous shales, whilst the actual high-grade seepages and proven deposits are located further from the foci of volcanic activity. The thickness of the various formations concerned was very considerable, and the difficulty in testing the economically workable deposits that probably existed would be their location.

The Sub-Andean area, on the other hand, derived its oil from Devonian rocks, the occurrence of which beneath the other area was problematical, for on the Puna the Cretaceo-Jurassic lay direct on Siluro-Cambrian rocks. Any seepages found in the Sub-Andean region issuing from the Cretaceous or Jurassics were probably of secondary origin and derived from the Devonian, a formation of black shales and some micaceous sandstones, very well seen in Bolivia, whence sufficient palæontological evidence had been obtained to deduce its age.

A point of interest regarding the character of the oils from the two districts is that Dr. Ernesto Longobardi, in a work published in Buenos Aires in 1909, suggested that they are chemically very similar, and are naphthene oils with a certain amount of aromatics. This being so, it was curious that they should come from such widely different horizons, and he wondered whether this afforded any ground for regarding the Neuquen oil also as only secondary and perhaps from concealed Devonian strata.

Mr. Hunter had quoted a succession which he and Mr. J. Romanes had established some years ago in Bolivia. The names of the divisions used are, of course, local and perhaps not now of general interest. Since then quite an amount of additional work had been done in linking up Northern Argentina and Bolivia, and in

determining the ages of the formations of the Sub-Andean rocks. Thus, the Lower Sandstones or "Mandiyuti Beds" were clearly divided into two series, of which Dr. Bonarelli had shown that the lower may be taken as Permo-Carboniferous and the upper as Trias. Further, according to Bonarelli, the base of the Dolomitic series was probably Trias, the rest largely Lias with possibly some Lower Jurassics. The "Upper Sandstones" are Cretaceous, and the base of the "Sub-Andean Tertiary" had been ascribed to Paleocene age from certain lamellibranchs found by Romanes near the Rio Grande by Abapo.

Mr. E. H. Cunningham Craig desired, in the first place, to congratulate the author on the admirably clear way in which he had put the facts connected with the oilfields of Argentina before the Institution. Personally he did not think a better or more comprehensive account of the subject could have been given in the time at the author's disposal. Unfortunately, he had not been in Argentina personally, but in the last few years maps and reports from, he thought, every one of the fields that had been described, had passed through his hands. He desired in particular to pay a tribute to Dr. Bonarelli, who seemed to him to have done most excellent work, especially in the area in the State of Jujuy and northwards towards Bolivia. Dr. Bonarelli's account of the structures and of the formations there was quite the best thing he had seen in any publication connected with the Argentine. Of course, the great question for consideration was the age of the oil in that part of the world. The structures were well worked out; they seemed quite simple and sometimes very favourable; but the occurrences of oil were at so many different horizons that it was very difficult to say which was the formation which would be best worth drilling in order to tap the oil. It had been impressed upon him for some years that the greatest success would probably be found along the Sub-Andean regions, although it was quite possible that many fields would be found in the more or less concealed structures nearer the coast. But he thought it was along the Sub-Andean structures where the folds ran roughly parallel with the mountain range that the best results would in the end be found in Argentina.

Mr. W. B. Hume said he desired, in the first place, to add a word of congratulation to the author on his excellent paper. The Argentine was such a very large area that it was almost impossible for one man to deal with it adequately, and as Mr. Madgwick had referred to the northern area, perhaps he (the speaker) might be permitted to add a few words with regard to the southern area. He had made a rapid visit over the southern area from Comodoro Rivadavia southward to Santa Cruz. Nearly every part of that

area was covered with the Patagonian formations, which, as the author said, appeared to be almost entirely horizontal. They were not absolutely horizontal, but some formations of very gentle anticlinal structure and gentle foldings could be made out by a careful survey. For instance, if one stood some distance inland behind Comodoro and looked towards the sea, it would be found that the Upper Patagonian beds, instead of taking the general gradual dip towards the sea, were rising up slowly, as though the oilfield of Comodoro was covered over by an anticline or an elongated dome in the upper structure. He could not say whether that was the case or not, because it was quite impossible to make any surface survey either over the Government field or the property of the Astra Company, as they were very particular not to allow anyone to do anything of the sort. In fact, Dr. Trumpy, who was working for the Royal Dutch, was arrested on the Astra property, and he was warned off for getting too far into the Government reserves. As he saw no reason to run the same risk himself, he did not go very far into either of them. But even if, after a careful survey of the structure, folds in the Patagonian were made out, there were still the unconformities underneath, and they did not know what relationship might exist between those folds and the structure in the Cretaceous beds where the oil was to be found. Both Dr. Trumpy and Dr. Keidel were working out the domes and anticlines in the upper structure of the Patagonian, and drilling through them in the hope they might find that there was some connection between at least the larger features in the Patagonian and the Cretaceous underneath, but he did not know what success they had achieved. It seemed to him that the only way of deciding that point would be by making an accurate survey of the surface and by making a careful study of the logs of the various wells. It was very difficult to collect all that information in a short time, and personally he came away without obtaining much impression as to whether such a relationship existed or not. As the author stated, in the Neuquen district the surface anticlines seemed to run in an east and west direction, whereas the under ones ran in a south-west to north-east direction. Whether similar discrepancies occurred between the directions in the Comodoro district or not he did not know. So few facts were known about the structure in the Comodoro district that necessarily a great many theories had been put forward, the first being that not only the surface beds were horizontal but also the oil-bearing beds. It was held that those beds were lenticular, and that the driller might happen to hit the lenticular sand with oil under high pressure, though how the oil accumulated in these flat lenses he did not know. That might or might not happen anywhere, and therefore it did not matter where the companies took up their concessions. Conse-

quently concessions were taken up at random, very often close up to the Government field, where one would expect, if there were any structures underneath, they would be in the drainage area from which the Government field derived its oil. Attempts to drill wells at random in different parts of the country, in the hope of hitting some oil, could hardly be recommended. Attempts had been made as far south as Santa Cruz and San Julian, but he did not think very many attempts would be made in that part of the country, although there was quite a possibility of finding other fields as Comodoro had been found. Possibly from a commercial point of view it would be best to leave those places in which there were no surface indications whatever to be discovered by the Government when drilling for water once more.

Mr. F. M. Penney said he desired, in the first place, to congratulate the author on his most valuable paper. One point of broad geological interest was the statement that: "In Palæozoic times the present continent of South America formed part of the Brazil-Ethiopian Continent, Gondwana, which extended from South America to Africa." He desired in that connection to be allowed to make a few remarks on something he had lately seen on the other side of the ocean which separated those two countries, namely, in South-West Africa, which he thought amply went to bear out the theory regarding that ancient continent. He gathered that the author stated that, roughly speaking, he found in South America the Mesozoics lying directly on the old granitic rocks. On the other side of the ocean, in South-West Africa, exactly the same thing occurred. Near the coast-line in South America they were Jurassics and Triassics. He did not gather, however, that the Cretaceous actually lay on the old granitic rocks, but in South-West Africa the Cretaceous were actually in contact with the granitics. Another parallel was that above the Cretaceous the Tertiary existed very much in the same way as the author described the Patagonian Tertiaries did, i.e., practically horizontal, almost without perceptible dips. Again, in regard to the Cretaceous, in South-West Africa there were the variegated sandstones as in Argentina. The author stated that in one part of the district of Neuquen some of the folds had their axes roughly east and west. Exactly the same thing occurred in the Cretaceous on the South-West Coast of Africa, where also, on penetrating inland, towards the mountain ranges, one encounters Devonian rocks as at Jujuy and Salta in America. Again, with regard to the question of oil, such oil as had been found in the part of the world that he had been to was a heavy oil. The Comodoro oil was 0.912, whereas in South-West Africa it was 0.945, another point of interest. The author has also referred to the rafaelite in South America. In

South-West Africa there was another peculiar solid bituminous hydrocarbon called Libolite, which possibly was very much like the rafaelite of which the author spoke. Another matter of general interest was the statement made by the author that he had great hopes of the Jurassic rocks in Argentina. It would be a very fine thing if that proved to be the case, because it seemed to him that a new system would then come in as a big oil producer. Taking Dr. W. Harvey Emmons' book, "The Geology of Petroleum," as his authority, it would be found on pages 14 and 15 that Dr. Emmons showed that the Jurassic, the Triassic and the Cambrian were the systems which had not as yet given any production of oil of any consequence, and if, as the author hoped, the Jurassics of Argentina gave a fine production of oil, it would be a great advantage to the world. That was all he desired to say on the geological side of the paper, but he wished to ask a question on a practical subject, namely, could the author give a little more information in regard to the hollow rod system which he used with the No. 30 Star Rig, in particular the pressure at which he pumped down the water inside the hollow rods. It would also be of interest if the author could give some information about the texture of the lenses in which the oil was found; whether it was a pure sand or sand mixed with clay or shale, and also the thickness of the lenses themselves.

Mr. W. G. Weeks said that one of the speakers had dealt with the far north and another with the far south. Personally, he happened to have had a little experience of the middle of the country described by the author—in the Sub-Andean zone which Mr. Cunningham Craig thought would be *the* zone of production From what he had seen he had been much impressed with the tremendous amount of faulting which took place directly under the hills, which made it very difficult to site any well satisfactorily. In Cacheuta the author described it as a more or less simple fan structure, but where there was any folding, the folds were crossed and cut up by so many faults that it was extremely difficult to say in what formation the well would end if it went to any particular depth. There was one question he wished to ask the author about Comodoro. The significance of that field seemed to him to lie in the fact that it was so far away from the main axis of folding of South America, and it suggested that in those wide flat regions northwards there might possibly be similar fields with no more sign on the surface of their existence than there had been at Comodoro. The only way that he could see in which one could hope to find such fields was by the geophysical methods that had been applied in other parts of the world. The question that arose in his mind was, whether the author thought that the subterranean

structures at Comodoro were sufficiently marked to allow of their being revealed by geophysical methods. He knew, however, of no signs of oil east of Mendoza in the centre of the Argentine.

Mr. C. Dabell said he possessed a few figures regarding the production of the Comodoro Rivadavia fields compiled by a gentleman who had considerable experience out in the field, and which he thought might be taken for granted unless anybody could bring bring forward strong objections to them. The figures related to four years' production of the first 41 producing wells drilled by the Argentine Government. The total production for those wells was approximately 828,000 tons. The interesting point of the figures was that the average productive life of a well in the Comodoro field was four years, and that in the first year of the four it produced on the average 48 per cent. of its total production; in the second year 20 per cent.; in the third year 13 per cent., and in the fourth year 9 per cent. The balance of 10 per cent. should be allocated to wells whose productive life had exceeded the four years average. The figures also showed that although 48 per cent. of the total production of the well was given in the first year, some of the wells had given 75 per cent. of their total production in the first year, the second, third and fourth years showing a proportional decrease. In reading his paper the author omitted to read the statement that: "Considerable interest attaches to the thick layer of finely laminated black shale, which overlies the first oil-bearing sandstone." He thought that referred to the Mendoza area. Looking through the logs of certain wells drilled in the Comodoro area, he found that at a depth varying from 320 to 380 metres a similar laminated black shale was reported giving slight signs of gas. He did not know whether it was possible to connect that at all with the Mendoza field.

Mr. Campbell M. Hunter, in reply, said he was very much interested in the remarks Mr. Penney had made about South-West Africa, which extended the knowledge obtained in the Argentine across the Atlantic. As a matter of fact, similar conditions were found even further eastward, namely, in India, where the great Gondwana system is composed of a mass of strata probably in the main of fluviatile origin. Mr. Penney had asked a question regarding the hollow rod system worked off a Star drilling machine. Most of the members had probably had occasion to drill in heavy, sticky formations, in which it was impossible, when using cable tools, to get a clean stroke. Such had been the case at Comodoro Rivadavia, where the formations were very lenticular, sometimes being only about six inches thick, while they alternated rapidly from sands to clays and vice versa. Further, heavy oil, gas and water followed in a most confusing sequence. Under these condi-

tions it was found almost impossible to drill with cable tools. A trial was thereupon made with hollow rods with heavy mud injection, in place of the wire rope, and satisfactory progress was at once obtained. Instead of using a short, rapid stroke as in the Fauck system, a long slow stroke of from 12 to 18 inches was employed. By reversing the injection, excellent cores were obtained, which enabled the drillers to rapidly and accurately feel their way and secure precise information about the nature and thickness of the formations, which previously had not been obtainable. It was soon found that the thickness of the lenses varied enormously, and the interesting fact was established that the richest oil-producing sands in the Comodoro district rarely exceeded 6 feet in thickness. Even so, some of the big wells had flowed for long periods from sands that were only three, four and five feet in thickness.

Regarding the question of trying to account for the sub-structure at Comodoro Rivadavia, surface indications gave no assistance at all. Personally he had been fortunate in being allowed to examine the Government property, where the Government staff had rendered him every possible assistance, but he was obliged to admit he could not find any correlation at all, certainly not in detail, between surface outcrops and the underground structure of the oil series. The structures which had been responsible for big productions at Comodoro Rivadavia were essentially long, relatively narrow, folds, and he felt that even in describing them as "folds" he was wrong. They appeared to him to conform more to the conditions that would be found at the mouth of a delta, as they suggested sand banks which had been subsequently covered over by marine formations when the whole country subsided.

The question raised by Mr. Weeks, as to whether, in the author's opinion, geophysical methods could be applied to the determination of suitable subterranean structures at Comodoro Rivadavia, cannot, in the absence of actual trial, be definitely answered. It would appear, however, that such methods are not likely to be applicable to the conditions as at present known in the Argentine, more especially since the oil occurrences are nowhere associated with such distinctive mineral features as masses of rock salt.

In the absence of further details of the figures quoted by Mr. C. Dabell, the author was unable to deal with them. On the other hand, the figures being based on only four years' production of the first 41 producing wells drilled by the Argentine Government, the conclusions to which they point do not afford a fair basis for judging the field as a whole. A more correct and complete interpretation of the results obtained to the end of 1922 may be arrived at by dividing the total Government production, 1,708,000 tons, to the end of that year, by the total number of wells drilled to the

end of 1922, whether productive or otherwise, namely 173. This indicates an average production per total well drilled of 9,873 tons. Considering that 72 per cent. of the above wells were still producing at the end of 1922, it was fair to assume that the ultimate total production per well on the Government property will approximate 13,000—15,000 tons. Consideration of other figures leads the author to estimate the average useful life of wells in the Comodoro Rivadavia Field at from 7—10 years.

With regard to the black shale at Mendoza, he was afraid he could not correlate nor identify it with anything found at Comodoro Rivadavia. There must be many thousands of feet of formation between the two, and to the best of his information no shale at Comodoro Rivadavia had ever been tested with a view to seeing if it was oil-bearing or not.

In conclusion, he thanked the members very much indeed for the kind way in which the paper had been received.

On the motion of the President, a very hearty vote of thanks was accorded to Mr. Campbell M. Hunter for his interesting paper, and the meeting terminated.

INSTITUTION OF PETROLEUM TECHNOLOGISTS.

THE EIGHTY-SECOND GENERAL MEETING of the Institution of Petroleum Technologists was held at the Royal Society of Arts, John Street, Adelphi, London, on Tuesday, December 2nd, 1924, Prof. J. S. S. Brame, F.I.C., F.C.S., Past-President, in the Chair.

THE CHAIRMAN, at the opening of the meeting, said that, unfortunately, the President, Mr. Herbert Barringer, was absent owing to a sudden illness which required an immediate operation. He was now in a nursing home where, he was glad to say, he was progressing very favourably. He was sure it would be the wish of all the members that the President would recover rapidly and be with them again at the next meeting.

THE SECRETARY read the following list of the newly elected members :—

Members.—Daniel McPherson Armstead, Kenneth Arnold Barringer, John Arthur Carpenter, Seaton Elliott Fox, Hiram J. Halle, John Bright Hoblyn, Toshikazu Niiya, Frederick James Rigg, Robert Hamilton Trench.

Transferred to Member.—William Edward Douglas Cole, Gerald Lindsay Hunting, Launcelot Owen.

Associate Members.—John Maurice Brown, Andrew Thomas Buchanan, James Lindsay Buchanan, John Mortimer Penney, Harold James Vincent, Stuart Sidney Webb-Bowen.

Transferred to Associate Member.—Victor Dvorkovitz, James Clark Templeton.

Students.—Anthony Gordon Engelbach, Jesse Ossawa Tanner.

Associates.—Herbert Bates, Alexis Lucien Caille, William Fraser Clements.

The following papers were then read :—

Fuel Oil Resources of the Future.

By ALFRED W. NASH, B.Sc., M.I.Mech.E.(Member), and H. G. SHATWELL, B.Sc.(Vict.), M.Sc.(Tech.), A.I.C.

INTRODUCTION.

PRACTICALLY since the inception of the Petroleum Industry, the availability of future supplies of mineral oil has been the subject of scepticism analogous to the opinions expressed from time to time regarding the future of the coal industry of this country.

Whilst petroleum, or bitumen, is known to have been used 3000 years B.C., nevertheless the petroleum industry is of comparatively

recent growth; yet hardly is the commercial value of the fluid realised before doubts are expressed as to the continuance of supply.

Within recent years, the production of oil has reached such staggering proportions as to cause many to anticipate the exhaustion of the mineral oil resources of the world in the near future.

The technical journals of America, which is the most highly-developed country so far as petroleum is concerned, ten years ago were seriously warning the country that the then rate of production of oil could not be maintained, and that a policy of conservation was imperative if the petroleum industry was to be saved from ruin. Excellent as this latter advice appeared then to be, the annual production of crude oil in the United States is now more than double that of 1913.

In 1921, the daily production from new oilfields alone amounted to, roughly, twenty-five thousand tons, or nine million tons in the year. During 1923, no fewer than seven new oilfields were discovered, and this in a country which is not only well populated, but which is being constantly explored and prospected with the drilling bit.

The fact that America is now importing large quantities of oil from Mexico does not prove the rapid exhaustion of its own deposits, but simply that the demand has exceeded the present available supply in that country: the question as to the future source of mineral oil, therefore, so far as America is concerned, is one which, in the authors' opinion, need not give rise to immediate disquietude.

Assuming the present-day commonly accepted theory as to the origin of mineral oil to be the correct one, then the existing supplies of petroleum cannot be expected to last for ever, any more than the reserves of coal can be expected to do.

It should be borne in mind, however, that, despite the rapid strides which the science of Petroleum Technology has made during its very short career, a greater advance in the time perhaps than any other applied science can show in its history, there are, in all its branches, with the possible exception of the engineering side, considerably more problems which remain to be solved than have been elucidated.

Before it can be stated definitely that the world's supply of petroleum will soon become exhausted, the following points, among others, need to be definitely established.

(*a*) That all the free petroleum which the earth contains has been located.

(*b*) That the problem as to the origin of petroleum in general, and each class of oil in particular, has been solved.

(*c*) That oilfields can be discovered, and not simply located as a result of surface workings by local inhabitants.

Bearing in mind the history of the American petroleum industry and the fact that outside that country the search for mineral oil has not been carried on diligently, it would appear as though the first point had not been established.

Further, a considerable portion of the earth's surface has not yet been explored, and large areas are still practically unknown; also the work of exploration in dense jungle is so difficult that the possibilities of oil being discovered in such places cannot be ruled out.

In regard to the second point, the problem of the origin of petroleum is no nearer solution than it was in 1888 when the development of Henkel's (1725) and Haquet's (1794) theories began to receive serious attention. It is impossible, therefore, to state definitely that oil is not in a process of natural formation at the present time.

The responsibility for the discovery of new oilfields does not rest on the geologist so much as on those responsible for his investigations.

Despite the fact that knowledge of the geology of petroleum is being promoted rapidly, those with actual field experience will agree that this science must, of necessity, always remain an inexact one.

When oil prospecting companies realise that a prospect cannot be investigated thoroughly by a geologist, by his simply noting the surface indications of the formation below, often within the space of a few days, and are prepared to send with him a drilling staff who would, in the first place, drill for geological information and not for oil, then the authors are convinced that further discoveries would soon be made.

Before discussing future resources, it would be as well, perhaps, to review our present position.

Many new oilfields have come into prominence within recent years, and these are now being exploited. As exploitation continues, so will geological knowledge of these particular areas increase, and there is no doubt that these fields will extend far beyond their present boundaries as has been the case with the older fields of America, Burmah, Rumania, Galicia, etc.

The recently-developed oilfield in Persia places this country fourth on the list of oil-producing areas, and there is no doubt this position can, and will, be improved in the future.

This country is one of the very few which has had close geological investigation bestowed upon it, with the result that it has been proved to contain oil-bearing strata extending from the southern coast of Persia, a little to the west of Bunder Abbas, right into Mesopotamia as far as Lake Van to the S.E. of Erzerum, a distance of 1,200 miles, and many structures favourable for the accumulation of oil have been discovered.

The production hitherto has been from the one area, the Maidan-i-Naphtun field, but other areas have been already proved. That even the comparatively small area comprising this field is a long way from being exhausted is proved by the fact that only some sixty wells have been drilled so far, which cannot be called "over-drilling."

All these wells came in as "gushers," and continue to flow under their own pressure with check control: one well has produced over six million tons of crude oil and was still producing when the last report was made public.

Needless to say, the colossal waste which has taken place on the American oilfields and elsewhere due to "offset" drilling as a result of the granting of small leases, will not be repeated in this field, and the most pessimistic must agree that it is a little too early to talk of the serious depletion of the oil resources of Persia.

The history of this field might easily be repeated in a number of places elsewhere where geological investigations are still being pursued, in conjunction with drilling work.

Other Free Oil Sources.

Other sources of petroleum are the various tar sands already known to exist in Canada, West Africa, Italy, Hungary, Albania and Russia.

Those of the Athabaska region, in Canada, are stated to have a thickness of two hundred feet at the exposed area, and seepages of heavy oil are to be seen along the river banks, as well as the exudation of natural gas. These tar sands are estimated to cover an area of ten thousand to fifteen thousand square miles, and the quantity of bitumen they contain represents from 12 to 20 per cent.

On distillation, a ton of this tar sand yields about twenty-five gallons of crude oil, giving about 10 per cent. gasoline, 27 per cent. kerosene and 56 per cent. lubricating oils.

Dunstan and Kewley (Crude Oils of the Empire)* state:—

"The exposure of tar sands in Athabaska is the greatest of pitch, tar and crude oil in the whole world, and greater than that of all the rest of the world put together. The contents, presuming the whole district produced the same amount as in the part examined, would amount to two hundred thousand million tons of oil, which would be sufficient to last the world, at its present rate of consumption, for about two thousand years."

Should only a quarter of the quantity estimated by these scientists as being available materialise on development, apprehension regarding the future might be left to posterity.

The quantity of oil which remains behind in an oil sand after a field has been abandoned as exhausted has called forth a controversy

* *Journ. Inst. Petr. Techn.*, X, 44, p. 497, July, 1924.

between production engineers, only equalled by the discussions which arise between geologists on the origin of oil. It is safe to say, however, that more oil is left below than is ever brought to the surface, and the work which is being carried on at Pechelbronn indicates not only the possibility, but the probability, of mining such sand and extracting the contained oil on a large scale.

It has been proved by De Chambrier, in his pioneer work on the extraction of oil from "exhausted" oil sands by means of "shafts" and "galleries" (*Journ. Inst. Petr. Techn.*, VII, 27, p. 182, 1921), that the quantity of oil which remained in the Pechelbronn oil sands after the field had been abandoned was roughly five times the amount which had been obtained previous to its alleged "exhaustion." Of this amount, half the quantity is being obtained by draining into galleries, and the balance, representing a further two and a half times the amount of oil obtained by drilling, can be extracted by solvents.

Whilst a certain amount of scepticism has been expressed by petroleum experts as to the practicability of mining oil sand, it should be borne in mind that ozokerite has been mined successfully in Poland for years and is still going on to-day and, despite the apparent danger of such work, accidents are very rare; there is no doubt that at some time in the future, remote though it may be, the mining of oil sands will be a successful everyday operation. For full particulars as to the free Petroleum Resources of the World, reference should be made to "Petroleum and Allied Products," 1924 (Imperial Mineral Resources Bureau, H.M. Stationery Office).

Future Developments.

Turning from the oil resources of the present to those of the future, mention should be made of the abundant stores of bituminous material from which oil can be obtained by destructive distillation. Those so far proved to be of value in this respect are:—

Oil-Shales.
Cannel coals and Torbanites.
Lignites.
Peat.
Coal.

Oil-Shales.

It has been stated, if oil is the "king," then oil-shale is the "heir-apparent."

Kerogen shales are heavy laminated rocks, free from grit and varying in colour from brown to black. A kerosene-like smell can be sometimes detected with some shales when freshly broken, but such smell is no criterion of the yielding properties of oil-

shale; neither can the fact that some shales will burn with a bright, but smoky, flame be taken as implying any commercial value.

Oil-shale is composed of two parts, the organic material, usually referred to as "kerogen," which on thermal decomposition yields crude oil similar in most respects to the petroleum obtained in a free state, and the inorganic material, which remains behind as ash after destructive distillation. The ash of some shales has commercial value as a fertiliser, of others as an ingredient for cement, whilst much shale ash has been found to be of no present value whatever.

The behaviour of different kerogen shales on distillation varies considerably, just as the shale from different parts of the same seam may vary; but they have one characteristic in common, in that the oil does not exist in the shale as such, and only a very small percentage of kerogen can be extracted when the shale is treated with solvents.

The proximate composition of an average Scottish shale, not dried, is as follows:—

	Per cent.
Volatile matter	25·5
Fixed carbon	4·95
Ash	69·55
Sulphur	1·44
Nitrogen	0·77

The volatile matter referred to above would consist of oils 12·7 per cent., water 6·5 per cent., gas and loss 6·3 per cent., which would represent a commercial yield of about 32 gallons of crude oil per ton of shale: the nitrogen would produce theoretically about 80 lbs. of ammonium sulphate per ton, but this figure gives no guarantee of the quantity of ammonium sulphate actually recoverable on a commercial scale.

The following represents the average yield of products from Scottish shale-oil:—

	Per cent.
Naphtha	4
Lamp oil	23
Gas oil	17
Lubricating oil	17
Hard paraffin wax	8
Soft paraffin wax	4
By-products	2
Water, gas and loss	25

Although the search for oil-shale has not yet been prosecuted with any great seriousness, nevertheless it is known that deposits exist in practically every civilised country in the world. The shales of Esthonia have been experimented with in the Scottish type of retort and found to yield 77 gallons of crude oil per ton, but the sulphate of ammonia yield is poor: the various oil-shales of

America yield from 10 gallons to 90 gallons of oil per ton, with an ammonium sulphate yield of from a few pounds to 34 lbs.

The New Brunswick shale deposits of Canada, when tested in Scotland, gave an average of 40 gallons of crude oil and 78 lb. of ammonium sulphate per ton; those of Southern France yield from 80 gallons to 120 gallons of oil per ton, whilst the Australian shales are reported to give 100 gallons of oil and 70 lb. of ammonium sulphate per ton.

The United States Government is holding 45,440 acres in Colorado and 86,584 acres in Utah of oil-shale deposits as a reserve for the use of the American Navy. The Colorado oil-shale fields cover an area of 2500 square miles, and those of Utah extend for a distance of 125 miles long by 40 miles wide.

The quantity of oil-shale estimated to be available in the Utah district is more than 40,000 million tons, and in Colorado 19,360 million tons, with an average yield over the whole of 38 gallons of oil to the ton: this represents a potential reserve of oil corresponding to 8550 million tons.

That the enormous deposits of oil-shale which are known to exist throughout the world are not yet worked seriously is due to several reasons, economic, financial and technical, but the chief reason is the present abundance and cheapness of free petroleum, which does not necessitate the immediate exploitation of these shales.

When the demand for petroleum exceeds the supply, then prices will naturally rise, and this will represent the period when the value of oil-shale as a source of petroleum will become established.

Unless the oil-shale problem is tackled before this occurs the high prices just referred to will prevail, just so long as the interval lasts between the real inception of the industry and the time when it becomes a commercial factor. When this point is reached, the oil industry will go on steadily, as it has done in the past, for many generations to come, possibly until such time as the need for petroleum may no longer exist.

Fears regarding future supplies of liquid fuel would appear to be groundless, therefore, although it is not the purpose of this treatise to suggest that all difficulties connected with the commercial utilisation of oil-shale have been overcome. The chief difficulties are mainly technical, and a considerable amount of research is still necessary to determine the most economical methods of treating the raw material, as it may be found that each kind of oil-shale will require a special design of retort for its efficient distillation and treatment peculiar to its kind.

That the exploitation of oil-shale on a large scale will be the next stage in the development of the oil industry may be considered conclusive, although it may not be within the time of

the present generation. For full particulars of the oil-shales deposits at present known to exist, reference should be made to "Petroleum and Allied Products," 1924.

Cannel Coals.—Cannel coal, and by this term is included torbanites, derives its name from the fact that it burns with a bright flame like a candle.

It is compact and strong in structure, with a dull lustre, and breaks with a conchoidal fracture; although not suitable for ordinary purposes it has been used as a gas-producing fuel.

Large deposits of cannel coal are known to exist both in this and other countries.

Whilst the analyses of various cannels must vary somewhat, an average sample has been found to contain:—

	Per cent.
Water	10·60
Volatile matter	30·72
Carbon	46·51
Ash	12·17

From experiments carried out with various cannels in this country, the following data have been collected:—

Yield of crude tar oil, from 30 to 70 gallons per ton.

Yield of sulphate of ammonia, 0 to 54 lb. per ton.

The tar oil obtained from cannel coal has a specific gravity ranging from 0·887 to 1·00, and contains from 0·4 to 1 per cent. of sulphur: the calorific value of the oil when dry being about 17,000 B.Th.U.

On distillation this oil produced:—

	Per cent.
Motor spirit	6
Intermediate oil	9
Fuel oil	51
Pitch	30

Very little research work has been carried out on these particular oils up to the present, however.

Lignites.—Lignite is a partly formed coal, usually brownish in colour, and is sometimes referred to as a brown coal; it is an intermediate stage between wood and coal, and shows the structure of the former. In Devonshire, there are extensive beds which are known under the local name of Bovey coal.

Since the early part of the eighteenth century, lignite has been mined and used as fuel in this country; deposits are known to exist also in Australia, America, France, Germany, Austria, Switzerland and Siberia. In Saxony, where the lignite deposits have been distilled for some years, the throughput is about 1,000,000 tons per annum, yielding 60,000 tons of oil and 7000 tons of paraffin wax.

The analysis of a lignite from the Federated Malay States has shown :—

	Per cent.
Volatile matter	38·7
Fixed carbon	39·26
Ash	1·04
Water	21·00
Sulphur	0·50

The tar oil from the Saxony Lignite has a specific gravity of 0·860 to 0·900, according to the locality, but the ammoniacal liquor is too poor for profitable ammonia recovery.

The yield of tar oil per ton of lignite represents from 20 to 30 gallons, which gives on analysis :—

	Per cent.
Benzine	2 to 3
Kerosene	12 to 15
Gas and Diesel oil	30 to 35
Lubricating and fuel oils	10 to 15
Paraffin wax	11 to 18
By-products	4 to 6

Peat.—Peat is a well known spongy substance of vegetable origin, common to almost every temperate country: the peat bogs of the British Isles cover an area of six million acres, varying from a few feet up to forty feet in depth. Pure peat, thoroughly dry, contains from 49 to 64 per cent. of carbon, and has a calorific value rather more than half that of a similar weight of black coal.

This material has been used in Germany for many years in the form of a peat coke, the oils, waxes and asphalts being marketed as by-products.

German peat yields per ton about six and a half hundred-weights of peat coke, and thirteen and a half gallons of tar.

The tar on distillation gives :—

	Per cent.
Light oil	45
Heavy oil	15
Wax	7
Asphalt	3½

The distillation of peat solely for the yield of oil would be a very unprofitable proposition, but should it ever become necessary to look to peat as a source of solid fuel, then the oil extracted would make a valuable addition to the existing oil supplies of that period.

Coal.—Many misleading statements have been made within recent years regarding the value of coal as a source of oil supply, and although very little research work, comparatively speaking, has been done on this subject, nevertheless, knowledge is sufficiently advanced for a definite statement to be made. Oil as obtained from coal by low temperature carbonisation, apart from any consideration as to the commercial value of the process, can never replace crude petroleum. This is due, in the first place, to

the fact that it contains no lubricating fractions, and, secondly, the oils of coal tars are similar to cracked oils in that they contain a large percentage of unsaturated compounds, which are very unstable, in addition to a quantity of phenolic bodies unsuitable as liquid fuel.

The low temperature carbonisation of bituminous coal was first seriously attempted in this country in 1906; the object was not the production of oil however; on the contrary, the tar obtained was then looked upon as being of very little importance, but the production of a smokeless fuel.

It is not within the scope of this paper to dilate on the value of smokeless fuel short of stating that to allow the valuable by-products of coal to go to waste up the chimney, adding daily to our densely smoke-laden atmosphere and causing the deaths of thousands of human beings annually in our thickly populated districts, is nothing short of criminal negligence.

In 1912–13, a Royal Commission was detailed to investigate the possibilities of obtaining fuel oil within this country, and as a result of their report, serious attention was directed to a proposed new carbonising industry founded on the distillation of bituminous coal at temperatures much below those used in gas retorts or coke ovens.

A Board of Fuel Research was constituted in 1917, with the late Sir George Beilby, F.R.S., as Chairman, and much valuable work has been carried out since by C. H. Lander, D.Sc., and his associates, in this direction.

Coal has been separated by the action of solvents into three main groups of compounds:—

(1) Alpha compounds, insoluble in pyridine.

(2) Beta compounds, soluble in pyridine, but insoluble in chloroform.

(3) Gamma compounds, soluble in pyridine and soluble also in chloroform.

Jones and Wheeler ("The Composition of Coal," *Trans. Chem. Soc.*, 1915, 107, 1318) found that the alpha and beta compounds yield, on distillation, very small percentages of phenolic products, whereas about half the gamma compounds distil below 400° C. yielding some oxygenated compounds (probably cyclic oxides) and a range of different hydrocarbons, chiefly unsaturated, identical with many of those found in natural petroleum, but no phenols.

A point of further interest arises, however, in that coal being composed of vegetable matter, amongst its constituents will be:—

(*a*) Cellulosic or humic derivatives.

(*b*) Resinous derivatives.

(*c*) Nitrogenous compounds.

and it should follow, *ipso facto*, that the resinic compounds and the gamma compounds already referred to, may represent one and the same thing.

Low temperature tar, when subjected to ordinary distillation, yields an oil consisting largely of unsaturated hydrocarbons, together with paraffins, naphthenes and probably smaller quantities of aromatics, with traces of methylnaphthalenes and a brittle poor quality pitch; also phenols, consisting of cresols, xylenols and others of unknown constitution, with nitrogenous bases.

The proximate analysis of bituminous coal varies with each grade of coal, but in a general way it will be found to be of this order:—

	Per cent.
Moisture	3 to 7
Volatile matter	30 to 35
Fixed carbon	50 to 60
Ash	3 to 10

H.M. Fuel Station estimate, from experiments carried out by them on both a small and large scale, that 14½ galls. of tar per ton of carbonised bituminous coal is the average quantity which could be relied upon from a fairly wide range of coals, if and when low temperature carbonisation is established on a national scale.

The quantity of crude oil contained in this tar is stated to be about 50 per cent., therefore the yield of oil per ton of coal carbonised would be of the order of 7¼ galls.

It is obvious that the retorting of coal by the low temperature carbonisation method for the extraction of oil alone can never be a paying proposition so long as the present economic relationship between coal and oil exists, and the Petroleum Engineer will have to wait until low temperature carbonisation can become established, as a result of educating the public to the advantages of smokeless fuel, before he can benefit thereby.

Nevertheless, if the small coal mined every year, amounting roughly to 50 million tons, which is either left underground or consigned to the waste heap, were treated by some system of low temperature carbonisation, about 365 million gallons of liquid fuel would be available annually, apart from the yield of good solid fuel suitable for domestic purposes.

That oil from carbonised coal can never replace natural petroleum is definitely proved in that not only is it of poorer quality, but the variety of products is very limited, e.g., lubricants, vaseline, asphalt, etc., are missing and there is a very high percentage of low quality pitch left as residuum: nevertheless, it can supplement, and therefore, help conserve the natural mineral oil resources, and the objectionable high content of unsaturated hydrocarbons in the motor spirit fraction might be overcome by careful physical, in

preference to chemical, refining and blending with motor spirits composed principally of paraffin hydrocarbons.

For full particulars as to the deposits of various types of coal and lignite known to exist throughout the world, reference should be made to "Coal, Coke and By-Products," 1923 (Imperial Mineral Resources Bureau, H.M. Stationery Office), and "Fuel," 1924 (Resources of the Empire Series).

The Berginisation of Coal and Oil.

Coal.—A second and much more promising method of obtaining oil from coal is by means of hydrogenation at very high pressures and temperatures of the order of 400° to 500° C. This process of hydrogenation was first patented by Bergius in 1914, and since then, a considerable amount of work has been done by him on these lines. It is stated that if coal, which contains less than 85 per cent. of carbon, is ground down to a fine powder, mixed with a mineral or tar oil, and the mixture heated for several hours with hydrogen at pressures over 100 atm. and temps. between 400°–430° C., the coal can be converted largely into a liquid product, which closely resembles a crude mineral oil.

The process has naturally aroused considerable interest because of the far-reaching effects which its establishment on a commercial basis would have.

The nature of the changes which take place when coal is liquefied or Berginised under the above-mentioned conditions appears to be little understood. In the first place, the division represented by the 85 per cent. carbon content is based on experimental results alone, but why coal containing less than 85 per cent. carbon should be readily amenable to hydrogenation and coal with a higher percentage than this difficult to liquefy is not clear.

Again, the Berginisation of coal will apparently only proceed in the presence of a mineral oil or some solvent which will dissolve out the liquid products as fast as they are produced. In experiments carried out at the Birmingham University by the Mining Research Laboratory under the direction of Dr. J. S. Haldane, F.R.S., assisted by Mr. J. Ivon Graham, M.A., M.Sc., in conjunction with the Oil Mining Department, on the hydrogenation of coal, it was found that very little change took place if the material were heated alone with hydrogen. If, however, the coal be mixed with a substance like phenol or a high boiling mineral oil, and then subjected to hydrogenation, considerable absorption of hydrogen occurs and a large proportion of the coal becomes liquid. In one case over 50 per cent. of the coal was transformed into a mobile liquid resembling a crude mineral oil, and there seems to be little doubt that the process should develop on a large scale.

For the experiments about to be described the Stopes classification of the macroscopic constituents of banded bituminous coal was used, and the three main fractions—clarain, plus vitrain, durain and fusain—were first dealt with.

The coal selected was clarain from the white seam, South Staffs thick coal, which, containing only 81·25 per cent. of carbon, should be readily amenable to treatment according to the views of Bergius.

The material was ground to pass completely through a 60 mesh, and was heated with hydrogen whilst being continually stirred by rotation of the high-pressure vessel.

The first experiment employed temperatures of between 390° C. and 420° C., the pressure rising to a maximum of 132 atmospheres, and the heating above 390° C. being continued for 30 hours.

No oil formation took place, and only a trace of extract was obtained by treating the product with chloroform.

A second experiment, using approximately the same temperatures and time, but pressures up to 154 atmospheres, rendered 5·73 per cent. of the product soluble in chloroform. The extract was a thick, black tar.

Thirdly, hydrogenation for five hours at temperatures between 400° and 420° C. and pressures up to 156 atmospheres was effected, followed by a second treatment for three hours with a fresh batch of hydrogen. In this case, 14·2 per cent. of a viscous, dark-coloured oil was obtained by extraction of the product with chloroform.

Since these results were disappointing from the point of view of oil formation, it was decided to employ a liquid medium as recommended by Bergius, and a previously hydrogenated mineral oil was taken.

The oil selected was a gas-oil fraction which had already been investigated previously in regard to hydrogenation. A 400 c.c. batch of the gas oil was first heated in the autoclave with hydrogen for four hours at a temperature of from 400° to 416° C. The residual gas was released and 150 grams of clarain were added to the oil and hydrogen admitted to a pressure of 36 atmospheres, the mixture being heated to between 400° C. and 415° C. for four hours, to a maximum pressure of 118 atmospheres.

The plant was left to cool all night, and the next morning the pressure was found to be nine atmospheres lower than the pressure at the commencement of the experiment. The residual gas was released and fresh hydrogen introduced, the whole being heated again to 400° C. for 3½ hours.

On cooling, the reduction in pressure was only four atmospheres, showing that hydrogen absorption was greater during the first day.

The product was a mixture of solid and liquid, the latter being black in colour and quite mobile, with the characteristic odour of cresol; it measured 365 c.c. in volume.

From experiments carried out with the gas oil under identical conditions, a permanent loss of 25 per cent.—due to gas evolution—was found to take place, leaving only 75 per cent. of the liquid used, remaining. Therefore, approximately 65 c.c. of the liquid product was derived from the coal; in other words, about 40 per cent. of the original gross weight of the clarain was obtained as liquefied coal. The solid residue contained 9·4 per cent. of a black tar, insoluble in mineral oils, benzene, etc., but soluble in chloroform.

The mobile oil contained no phenols or other substances soluble in caustic soda.

As it was impossible to separate the liquefied coal from the oil, it was decided to use in all further experiments a solvent which would be not only unaffected by the experimental conditions, but also easily separated from the liquefied coal product.

Phenol was treated under similar experimental conditions and was found to be quite stable; as it has the advantage that it can be removed completely from the products by chemical means and that it remains in the liquid phase under the experimental conditions, it was decided to use this as the solvent. It has one disadvantage, however, in that caustic soda, when removing the solvent, removes the phenolic substances produced during hydrogenation.

Two experiments were then carried out with phenol as the solvent, and the results may be summarised as follows:—

(1) Clarain hydrogenated in presence of phenol for three hours at 416° C. and 123 atmospheres (maximum) caused absorption of hydrogen of over 2 per cent. by weight. The recovered material consisted of 56·2 per cent. soluble in phenol and 20 per cent. of insoluble residue, there being a loss of 23·8 per cent.

The soluble portion yielded 53 per cent. soluble in chloroform and 47 per cent. insoluble, each product being a brown solid, but that soluble in chloroform having a low melting point.

On analysis, the chloroform soluble powder was found to contain about 7 per cent. of hydrogen; this product represented 30 per cent. of the original clarain.

(2) Clarain hydrogenated in presence of phenol for 13 hours over a period of four days, at 416° C. and 130—140 atmospheres caused a total absorption of hydrogen of 4·72 per cent. The recovered material consisted of 43·6 per cent. soluble in phenol and 21·4 per cent. of insoluble residue, there being a loss of 35 per cent. Of the phenol soluble portion, 60 per cent. was an oil soluble in chloroform and represented 37 per cent. of the original coal.

Thus 37 per cent. of the coal had been liquefied, giving a mobile oil which resembles a crude petroleum.

(3) The next experiment was carried out to substantiate or revoke the theory that hydrogenation of clarain in presence of phenol first necessitates solution of the whole, or a portion, of the coal with subsequent absorption of hydrogen by the solute, as this appeared to be one possible explanation of the observation that phenol or a mineral oil accelerated the reactions of hydrogenation.

Clarain was heated in presence of phenol in an atmosphere of nitrogen under similar conditions to experiment (1). Whilst the temperature treatment was practically identical in each experiment, the pressures developed in this experiment were considerably higher than in experiment (1). Also the final pressures in the cold showed a reduction of 12 atmospheres in the case of hydrogenation and an increment of 3 atmospheres where nitrogen was used.

There is no doubt, therefore, that substantial hydrogenation takes place in a hydrogen atmosphere.

There was a yield of 8·3 per cent. of material soluble in phenol comprising 60 per cent. soluble in chloroform, and the low percentage of phenol soluble material indicates that the theory of solvent action is untenable.

(4) Durain from the Hamstead " white " coal was hydrogenated in presence of phenol for four days, a fresh batch of hydrogen being admitted at the beginning of each day's run. It was found that 3·8 per cent. of hydrogen had been absorbed and the product consisted of 45 per cent. insoluble residue, 3·4 per cent. of a brown powder soluble in phenol, but insoluble in ether, and 34 per cent. of an ether soluble oil, there being a loss of 17·6 per cent.

The oil was dark brown in colour, and analysis indicated its hydrogen content to be 7·85 per cent.

(5) Fusain from the No. 2 Rhondda Seam, South Wales, with a carbon and hydrogen content of 94·99 per cent. and 1·99 per cent. respectively was hydrogenated under the same conditions as employed with durain. Very little change took place, there being recovered 95 per cent. of an insoluble residue, which appeared to be but little altered.

From the foregoing, the hydrogenation of coal under high pressure and temperature has been definitely established, and substantial yields of liquid products obtained.

Exactly what part the phenol or mineral oil plays in accelerating liquefaction is not clear. It has been proved by experiment (3) that hydrogenation followed by solution occurs, and it is suggested therefore that hydrogenation of coal might proceed without the aid of a solvent, were it not for the fact that the viscous liquid produced possibly prevents access of hydrogen to the coal. The nature of the liquids obtained by hydrogenating coal has not been elucidated so far, but they appear to contain oxygen.

It is proposed to treat this coal oil further, in order to see whether deoxidation and hydrogenation will take place simultaneously in a manner similar to the reaction which takes place when cotton seed oil is hydrogenated (see Waterman and Perquin, *Jour. Inst. Petr. Tech.*, x., 45, p. 673, Sept., 1924).

Before leaving this subject, it would be as well, perhaps, to review shortly the earlier work on hydrogenation.

Bergius first commenced his operations by attempting to synthesise coal. Cellulose was heated with water in an autoclave up to 340° C. and under a pressure of 200 atmospheres for a period of twelve hours: a black amorphous mass similar in appearance to coal resulted, which, on analysis, was found to be composed of 84 per cent. carbon, 5 per cent. hydrogen and 11 per cent. oxygen.

In view of these facts, the authors trust they will not be suspected of undue optimism when the suggestion is put forward that long before the existing resources of fuel oil become exhausted, synthetic mineral oil might be obtained by the hydrogenation of artificial coal.

Oil.—In regard to oil, many crudes exist which do not pay for refining in that they contain no appreciable amounts of low boiling and intermediate fractions: consequently, they are either marketed direct as fuel or not exploited at all.

If these heavy oils could be made to yield a certain percentage of motor spirit, together with a proportion of lower intermediate fractions, their intrinsic value would increase considerably, and such products would ease the prophesied calamity materially.

With ordinary pressure cracking methods a certain amount of synthetic motor spirit can be obtained from some oils, but the residuum is less limpid and in some instances has to be mixed with a lighter fuel oil to render it less viscid: as this difficulty is fundamental, it cannot be overcome by the present methods.

Bergius has claimed to hydrogenate heavy Mexican crude oils producing a fuel oil with a considerably reduced $\frac{C}{H}$ ratio.

No hydrogenation work has yet been carried out at Birmingham on heavy oils, so that we have no data to put forward, but very complete experiments have been made with a gas oil.

By treating this gas oil with hydrogen under pressure and temperature, it was found, by examination of the gases evolved, that 2 grams of hydrogen per 100 grams of oil had been taken up, apparently, by the oil. Upon analysing the residual gases, however, it was found that 2·7 grams of hydrogen had been released as permanent gas, which meant that a greater quantity of hydrogen had been evolved as methane than had disappeared from the hydrogen atmosphere; in other words, dehydrogenation had taken place.

As these results did not agree with preconceived ideas on the subject, it was decided to perform a blank experiment, using an inert gas.

During a number of experiments with nitrogen, it was noticed that the behaviour of the oil was quite different; for instance, a rapid increase in pressure took place at a lower temperature, showing that decomposition had commenced earlier. Also, this increase in pressure continued even after the autoclave had started to cool down, and the final pressure was much higher than the original, although the temperature and period of heating were less.

In this instance 2·9 grams of hydrogen were absorbed per 100 grams of oil, and it should be noted that this figure is in close agreement with the 2·7 grams obtained in the hydrogenation experiment.

These results, together with the analyses of the gases, indicate that under ordinary cracking conditions, considerable dehydrogenation takes place in the form of evolved hydrogen and methane. When hydrogen is employed in the place of nitrogen, however, dehydrogenation and hydrogenation take place simultaneously.

The initial boiling point of the original gas oil was 230° C., of the hydrogenated product 35° C., and of the "nitrogenated" product 44° C. The hydrogenated oil yielded 48·5 per cent. up to 175° C. and 74 per cent. up to 300° C., leaving a residuum which was very mobile. The "nitrogenated" product yielded 38 per cent. up to 175° C., but the residue above this point was considerably darker than the analogous residue from the hydrogenated product.

The iodine value of the hydrogenated crude, although considerably higher than that of the original gas oil, was much lower than that of the synthetic crude from the nitrogen experiment, and in this connection, it should be noted that both the resulting refined spirits were water white, but whereas the hydrogenated gasoline has a sweet smell and has retained its colour almost completely after standing in the laboratory for over a year, the petrol obtained from the nitrogen experiment possessed a slight cracked odour and its colour has deteriorated markedly in considerably less time.

If, by this method, heavy asphaltic oils can be converted into crudes yielding useful low boiling commercial products, then a valuable addition to the present fuel oil resources will result, as there are considerable deposits of such raw material awaiting commercial utilization.

Power Alcohol.—This report would not be complete without a reference to power alcohol. Unfortunately we have no data to put forward in this connection at the moment, but it is hoped to be able to do so at a later date as a result of research in conjunction with our Department of Bio-chemistry.

Whilst it is the authors' opinion that alcohol can never supersede gasoline, owing to its lower thermal value, nevertheless its future utility should not be ignored entirely, especially by the timorous. Indeed it has been stated (Ormandy-Power Alcohol "Fuel," (The Resources of the Empire) that with an engine specially designed with a higher compression ratio than at present used, "the consumption of alcohol is practically equal to that of petrol in the present-day motor," meaning per mileage.

Unfortunately, native sugar and starch are produced from natural foodstuffs, which must be already scarce, judging by the present day prices, and it is to be hoped that investigators will turn their attention elsewhere for their results.

The next best raw material would appear to be cellulose, in that there should be abundant supplies of this carbohydrate obtainable. Cellulose, which has the empirical formula $C_6H_{10}O_5$ is to be found in wood to the extent of about 60 to 70 per cent. of its composition.

By heating wood to a temperature of about 165° C. with 3 per cent. sulphurous acid, under a pressure of seven atmospheres a fermentable liquid is obtained from which alcohol can be extracted, and it is claimed that a ton of dry wood substance can yield from 30 to 35 gallons of alcohol.

It would appear as though much of the work carried out in this direction has not reached beyond the laboratory stage, although a considerable quantity of alcohol was produced from sawdust by this fermentation process in America during the war, and a motor spirit containing 60 per cent. of alcohol is at present being used in South Africa.

The chief difficulty would appear to be the cost of production which, very probably, arises from the usual technical problems common to all new methods of manufacture.

Conclusion.

In attempting to allay any uneasiness which appears to exist in the minds of many as to adequacy of fuel oil for the next few generations, it is not intended to suggest that scientific and technical researches, such as have been indicated, should be left to posterity. On the contrary, it is definitely asserted as a considered opinion that it is our duty to posterity to probe every possible expedient which presents itself for the conserving and supplementing of our existing supplies of fuel oil in order that the difficulties of the future may be, at any rate, partially, if not completely, solved.

Somerset Oil-Shales.

By H. G. Shatwell, B.Sc. (Vict.), M.Sc. (Tech.), A.I.C.,
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Introduction.

In view of the importance to this country of any new discovery of indigenous oil-shales, it was thought to be of more than passing interest to inspect the Somerset deposits, to collect samples of the shale and to examine them in some detail from the standpoint of oil, gas and ammonia yields.

Accordingly, the authors, in company with Dr. T. D. Jones, of the Mining Research Laboratory, University of Birmingham, inspected in June last the outcrops in the vicinity of Kilve, secured samples of shale from five different seams, together with a sample of oil actually produced in the retort in operation, and submit herewith an account of their investigations.

Owing to the limited time available, it was only found possible to examine the actual outcrops along the coast between Blue Anchor and Kilve, and no attempt was made to trace the course of the strata at any distance from the sea coast.

During the course of the discussion on a paper by Dr. Forbes Leslie read before the Students' Section of the Institution of Petroleum Technologists at Birmingham, in June, 1924, Professor Boulton referred to the existence, in South Wales, of bituminous shales similar to those described by the lecturer: and in this connection, and at our request, Dr. Jones visited some quarries in the vicinity of Penarth.

Through the kindness of the proprietors, samples of the shales exposed there were forwarded to Birmingham, and their examination has been conducted in a similar manner to that of the Somerset shales. A comparison of the results will be found to be of great interest.

Geology.

The Somerset oil-shales extend for some ten or twelve miles along the Somerset coast, running West to East from the vicinity of Blue Anchor, and they appear as beds of black to brown shales, alternating with bands of argillaceous limestones, to a distance of one to three miles inland.

These shale deposits are divided into two basins by the Devonian ridge of the Quantocks, that on the East being known as the

Lilstock Basin and the Western and smaller area is called the Doniford Basin.

Faulting, as seen from the foreshore, is more or less symmetrical and appears as a series of fractures with downthrows to the East.

Three classes of sediments can be observed, viz., limestones, calcareous clays and marls, and oil-shales: these belong to the Lower Lias age and to the Rhætic intermediate horizon.

The stratigraphy as seen along the coast is very easy to follow, in that it is a continuation of limestones and shales: the limestones have a thickness of from a few inches to 2 ft. 6 in., whereas the shale seams vary from 1 to 20 ft. in thickness.

In the two basins referred to, the angles of dip vary somewhat, but generally it may be taken as between 20 to 30 degrees inland on the coast, and about the same amount seawards on the landward outcrops. West and East, the angle of dip is much steeper, flattening out from each direction in the synclinal basin.

Dr. Jones was asked to investigate the South Wales side of the Bristol Channel and the following represents a condensed summary of his report in this connection:—

The Lower Lias, which is situated between the Middle Lias and, generally, the Rhætic beds of the Triassic formation below, has been known for many years to contain dark bituminous shale.

That the presence of bituminous shale in Somerset in the Lower Lias was definitely established many years back is confirmed by a reference in "The Geology of the Country near Sidmouth and Lyme Regis" (*Mem. Geol. Survey, England and Wales*, 1911), to the spontaneous combustion of these bituminous shales in August, 1751, and again in January, 1908, due to the presence of pyrites in the cliffs.

The presence of bituminous shales occurring in the Lower Lias along the South Wales Coast has been known to geologists, with a knowledge of that district, for nearly 30 years, and there is no doubt that the oil-shales on the Somerset coast are a continuation of this series.

Figs. 1 and 2 show sections on both sides of the Bristol Channel, and it will be noticed that the area covered by the Lower Lias on the South Wales side is greater than that on the Somerset side. Fig. 3 gives a section across the ridge of the Quantocks showing the location of the two basins in which the Somerset oil-shales are found.

The lithological character and the structural features on the South Wales side of the Channel are similar to those found on the Somerset side, inasmuch as the Lower Lias series is greatly faulted, the line of the faults in each case being practically at right angles to the shore.

On the Somerset side, however, the beds of oil-shale are thicker, those on the South Wales side being only from 6 in. to 5 ft. in depth.

Both the South Wales and Somerset oil-shales exhibit conchoidal fracture, and also slight curling when scraped, but not to the same extent as those found in the Carboniferous system of Scotland: the kerosene-like odour of the freshly broken shale is common to the exposures on both sides of the Channel.

The South Wales shale beds are practically flat and should, therefore, be the more easily quarried, but the general topography on the Somerset side does not follow the angle of dip of the shale deposits, with the result that the overburden increases rapidly in this area.

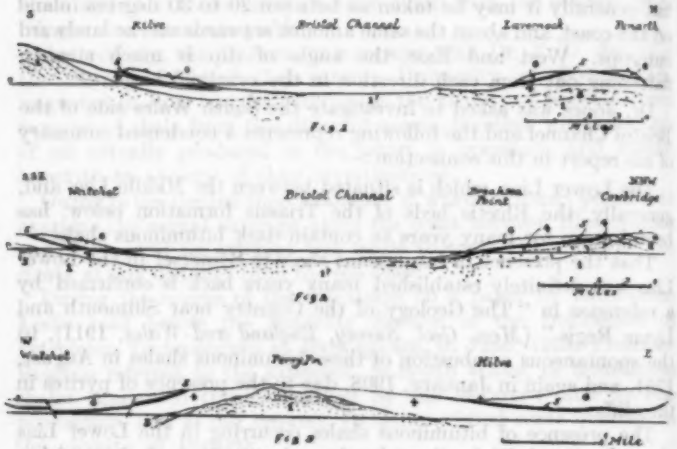


FIG. 3.

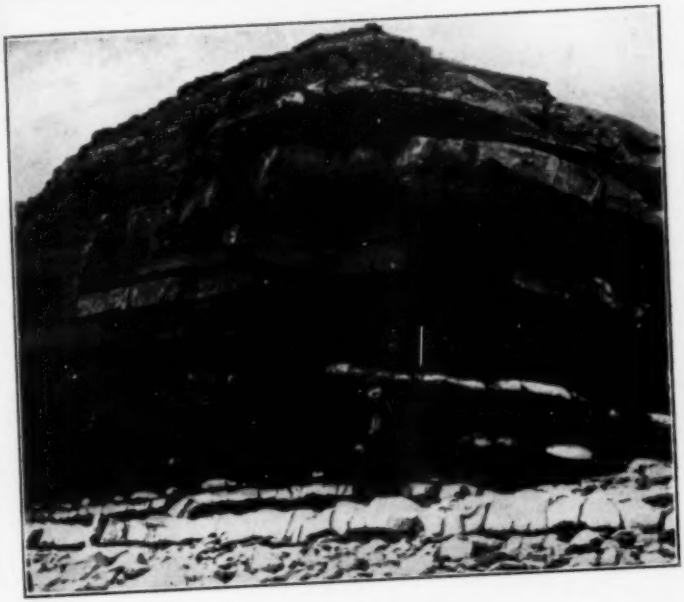
SKETCH SECTIONS SHOWING THE RELATION OF THE LIASSIC OIL-SHALE FIELDS OF SOUTH WALES AND SOMERSET.

(NOTE.—The vertical scale is much exaggerated.)

Key.—1, Old red sandstone. 2, Carboniferous limestone. 3, Permian. 4, Trias. 5, Rhætic. 6, Lower Lias.

This statement is substantiated by the fact that in a borehole sunk near the Kilve Priory (less than half a mile from the cliff), 300 ft. of overburden was drilled through before the shale beds were reached.

The easiest method of winning the shale at first would be by quarrying, but mining would soon have to be resorted to, and in this connection it is doubtful whether the limestone would make a safe roof, owing to its jointed character, and it would probably be safer to use the shale for this purpose.



OIL SHALES OF SOMERSET.

STOL
CHANNEL
Bridgwater Bay

The Examination of the Shale.

Six samples of shale were taken from the Somerset deposits. Quarrying was actually in progress, so that each portion represents a fair average specimen of five seams outcropping at Kilve, number one being the lowest and number five the highest of the series. Sample six was taken from a heap of material which was waiting to be dealt with in the retort. Owing to a subsequent error, sample two was mixed with sample three, and the results for these two seams are grouped under the heading sample three.

With regard to the South Wales shales, two specimens, namely, "9-in. shoddy" and "Under 6-in. shoddy," were secured.

A sample of Scottish shale was also obtained through the kindness of Messrs. Scottish Oils, Limited. It was stated to give a yield of 20 gallons of oil per ton on a large scale, and its inclusion in the present paper was considered advisable in that it served as a check upon the accuracy of the methods of distillation employed.

Preparation of the Shale.

The whole of each sample of shale was broken into small pieces, thoroughly mixed to ensure homogeneity, and about a pound of each ground down so as to pass completely through a 60's. mesh. The prepared specimens were then stored until required in hermetically sealed jars.

The powdered substance was employed for proximate analyses assays, and analyses of ash, while the pulverised portions were used for distillations in steam.

Proximate Analyses.

The results of proximate analyses are shown in Table I. below. Specific gravities were determined using the substances, both in powdered and lump form, moistures by heating a weighed portion of the powder to 105° C. *in vacuo* and collecting the evolved moisture in a weighed calcium chloride tube, and volatile matter by heating one gram of shale in a closed platinum crucible for seven minutes at a temperature of 950° C. (Standard American Method). The content of sulphur was ascertained by the method adopted in coal analysis (Eschka's Method), i.e., by ignition with a mixture of sodium carbonate and light magnesium oxide and subsequent precipitation of the sulphur as barium sulphate, while the percentage of carbon dioxide was determined by Sinnatt's modified form of Knopp's azotometer.

Duplicate or triplicate experiments were carried out in all cases, and the results given are the means of at least two determinations which differ only by reasonable experimental error.

TABLE I.

Proximate Analyses of Somerset and South Wales Oil-Shales.

Sample.	Somerset Shales.					South Wales Shales.		Scottish Shale.
	1	3	4	5	6	9 in. Shale.	6 in. Shoddy.	
Sp. gr.								
Lump ..	—	—	—	—	—	2·28	2·29	1·84
Powder ..	2·46	2·38	2·41	2·49	2·36	2·34	2·33	2·04
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Ash	72·30	73·75	70·17	70·80	71·46	76·12	67·57	73·45
Moisture ..	4·03	3·11	2·95	3·15	3·27	3·57	2·37	3·41
Volatile less H_2O ..	23·86	28·40	24·23	28·85	25·75	22·00	28·28	20·32
Sulphur ..	2·25	4·52	2·74	1·70	3·75	1·99	1·97	—
CO_2.. ..	14·85	15·85	17·60	18·29	13·59	11·22	20·63	1·50

The chief points of interest suggested by the above figures are:—(*a*) The specific gravities are higher than that of the Scottish sample. (*b*) The unusually high content of carbonates which, calculated as $CaCO_3$, are equivalent to 25·5 per cent. and 46·9 per cent. in the case of the two South Wales samples and between 30 per cent. and 42 per cent. in the case of the Somerset specimens. Assuming that the whole of the carbon dioxide is evolved during the estimation of content of volatile matter, the percentage of the latter from which oil is derived will be considerably reduced, the results being shown in Table II.

TABLE II.

Volatile Matter less Carbon Dioxide.

Somerset Shales. Per cent.					South Wales Shales. Per cent.		Scottish Shale. Per cent.
					9 in.	6 in.	
1	3	4	5	6	Shale.	Shoddy.	
9·01	12·55	6·63	10·56	12·16 ..	10·78	7·65 ..	18·82

ANALYSES OF ASH.

In Table III below are shown the results obtained by analyses of the ashes remaining on igniting the various shales.

TABLE III.

Analyses of Ashes.

Substance.	Somerset Shales. Per cent.					South Wales Shales. Per cent.	
	1	3	4	5	6	9 in. Shale.	6 in. Shoddy.
SiO_2	39·76	36·32	32·81	35·73	22·34 ..	44·38	29·18
Fe_2O_3, Al_2O_3 ..	20·93	20·68	19·94	16·52	31·09 ..	18·06	16·48
CaO	28·93	30·13	37·28	40·80	34·69 ..	28·11	46·24
MgO	2·88	2·80	1·20	1·24	2·55 ..	3·34	1·09
SO_3	6·90	10·27	8·50	5·62	9·50 ..	6·13	6·81
Totals ..	99·40	100·20	99·73	99·91	100·17 ..	100·02	99·79

Table IV.

Results of Assays and Steam Distillations.

Shale	Somerset.										South Wales.				Scottish.	
Sample	1.		3.		4.		5.		6.		9 in. Shale.		6 in. Shoddy.			
A = Assay.																
S = Steam Distillation.	A.	S.	A.	S.	A.	S.	A.	S.	A.	S.	A.	S.	A.	S.	A.	S.
Oil yield (per cent.) ..	2·90	2·48	3·60	3·26	4·25	2·94	2·10	1·38	4·35	2·89	2·20	—	1·50	—	9·05	9·70
As gallons per ton	6·88	5·93	8·59	7·78	10·12	7·00	5·00	3·29	10·40	6·88	5·22	—	3·61	—	22·40	24·14
Light spirit from scrubbers ..	—	0·24	—	0·39	—	0·28	—	0·28	—	0·44	—	—	—	—	—	discarded
Total oil (galls. per ton) ..	6·88	6·17	8·59	8·17	10·12	7·28	5·00	3·57	10·40	7·32	5·22	—	3·61	—	22·40	—
Nitrogen (per cent.) ..	0·042	0·053	—	0·063	0·040	0·052	0·035	0·041	0·038	0·052	0·037	—	0·043	—	0·219	discarded
$(NH_4)_2SO_4$ (lb. per ton) ..	4·43	5·60	—	6·66	4·22	5·51	3·70	4·33	4·01	5·54	4·00	—	4·35	—	23·32	—
Gas (cub. ft. per ton) ..	1259	1523	1470	1996	1610	2000	1247	1338	1552	1745	990	—	1076	—	1682	—

A study of the above results clearly points out the similarity between the deposits in the two areas under consideration and shows also the fundamental difference between these and the Scottish shales.

Distillation of the Shale.

The distillation of the shale for the determination of oil, ammonia and gas yields was carried out by two distinct methods.

(*a*) *Assay.*—In this method, the finely powdered shale was distilled in the Assay Apparatus designed by Gray and King.* The apparatus consists of a silica tube placed horizontally in an electrically heated furnace, the temperature of which can be accurately controlled by means of a rheostat and which is indicated

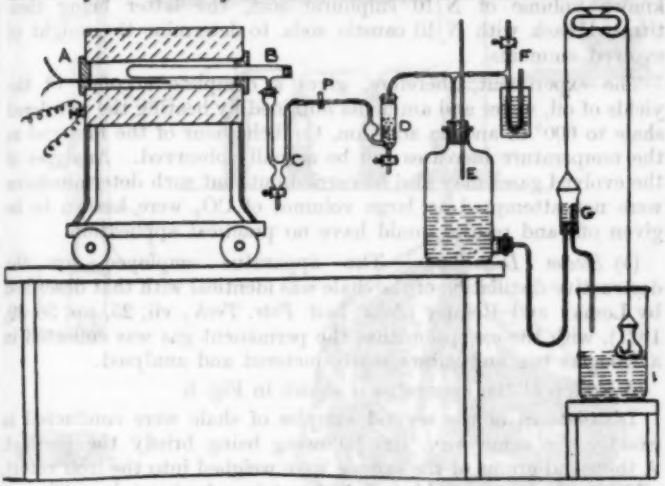


FIG. 4.

by a thermometer placed in close proximity to the silica tube. The outlet of the latter is connected to a weighed U tube in which the oil and water condense, the permanent gases being then conducted through a scrubber containing dilute sulphuric acid and thence to a gas holder filled with brine.

The gas receiver is supplied with a constant level device so that the distillation is carried on throughout at atmospheric pressure, and the volume of gas evolved is indicated by the volume of brine displaced.

Fig. 4 shows the main features of the apparatus.

To ensure concordance in the results, the following technique was adopted throughout. Twenty grams of the shale were

* *Fuel Research Board Technical Paper No.* 1.

accurately weighed into the silica tube and the apparatus assembled. The furnace was then heated from the cold, so that the temperature increased to 600° C. in one hour and was maintained constantly at this temperature for a further period of exactly one hour.

The whole was then cooled, the volume of displaced brine determined and the temperatures of water and gas ascertained.

The weight of oil and water contained in the U tube was noted, the mixture washed into a 10 c.c. burette with wet chloroform, the volume of water being read off, converted to weight, and the weight of the oil thus found by difference. The upper layer of ammonia water was then added to the acid contained in the scrubber, and the resulting liquid distilled with 50 per cent. caustic soda into a known volume of N/10 sulphuric acid, the latter being then titrated back with N/10 caustic soda to determine the weight of evolved ammonia.

The experiment, therefore, gives a complete account of the yields of oil, water and ammonia obtained by heating the powdered shale to 600° C. and, in addition, the behaviour of the material as the temperature increases can be actually observed. Analyses of the evolved gases may also be carried out, but such determinations were not attempted as large volumes of CO_2 were known to be given off, and results would have no practical application.

(*b*) *Steam Distillation.*—The apparatus employed for the destructive distillation of the shale was identical with that described by Lomax and Remfry (*Jour. Inst. Petr. Tech.*, vii, 25, pp. 36–39, 1921), with the exception that the permanent gas was collected in a Douglas bag and subsequently metered and analysed.

A sketch of the apparatus is shown in Fig. 5.

Distillations of the several samples of shale were conducted in exactly the same way, the following being briefly the method. A thousand grams of the sample were weighed into the iron retort, which was then assembled and placed in a horizontal position on a gas-heated combustion furnace.

The back end of the retort was connected to a steam can by means of a length of half-inch gas tubing, which was supplied with a coil for superheating the steam and with a 4-way connection; the latter allowed of steam being generated in advance without its being passed into the retort until required, while a thermometer could be inserted to indicate the temperature of the incoming steam.

The front end of the retort was connected, through a vertical metal condenser, to a Wulff bottle, in which oil and water collected, the outlet of the bottle being fitted with a second condenser which led, in turn, to a wash bottle containing dilute sulphuric acid, two bottles containing gas oil and finally to a Douglas bag.

The water in the boiler having been raised to ebullition, heating of the shale was commenced cautiously. When a distillate began to appear, steam superheated to between 180° C. and 200° C. was admitted and distillation continued for a total period of four hours.

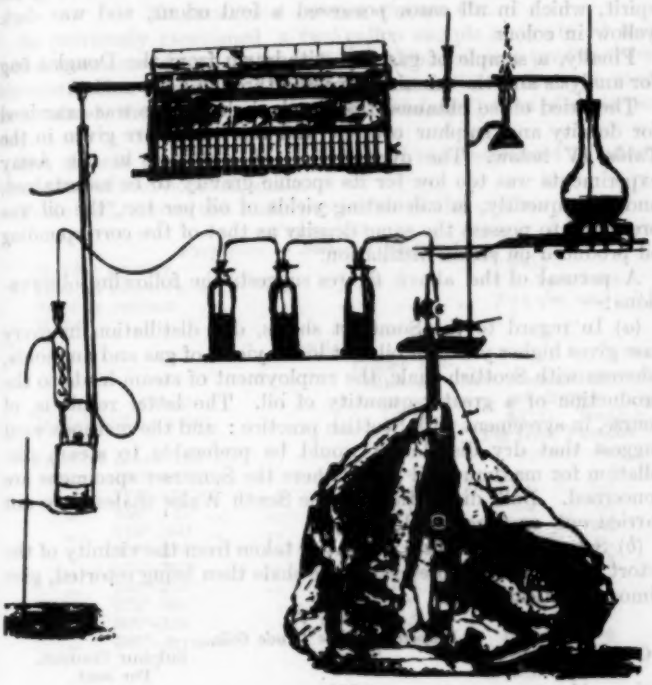


FIG. 5.

The temperature was gradually increased so as to maintain a continual evolution of oil, the retort during the final hour being heated to dull redness. In all cases, the back end of the retort was maintained throughout at a higher temperature than the front end, so as to crack, as little as possible, the oil produced during the treatment, whilst in all experiments the quantity of steam used corresponded to from 500 to 600 c.c. of water.

The mixture of oil and water obtained was transferred to a separating cylinder, the lower layer of water run off into the ammonia-scrubber, the oil dried for some days over calcium chloride and weighed.

The acid liquor in the scrubber was shaken with chloroform to free from colouring matter, made up to one litre with distilled water and an aliquot portion used for ammonia estimation.

The proportion of light spirit produced was ascertained by distilling the scrubber oil in a current of steam and collecting the spirit, which in all cases possessed a foul odour, and was dark yellow in colour.

Finally, a sample of gas was withdrawn from the Douglas bag for analysis and the remainder passed through a gas meter.

The dried oil so obtained from each shale sample was examined for density and sulphur content and the results are given in the Table IV below. The quantity of oil obtained in the Assay experiments was too low for its specific gravity to be ascertained, and consequently, in calculating yields of oil per ton, the oil was presumed to possess the same density as that of the corresponding oil produced on steam distillation.

A perusal of the above figures suggests the following observations:—

(*a*) In regard to the Somerset shales, dry distillation in every case gives higher yields of oil, but lower yields of gas and ammonia, whereas with Scottish shale, the employment of steam leads to the production of a greater quantity of oil. The latter result is, of course, in agreement with Scottish practice: and the methods used suggest that dry distillation would be preferable to steam distillation for maximum oil yield, where the Somerset specimens are concerned. Bulk distillations of the South Wales shales were not carried out, as time was limited.

(*b*) Samples four and six, the latter taken from the vicinity of the retort at Kilve and representing the shale then being retorted, give almost identical figures.

TABLE V.

Properties of the Crude Oils.

Oil from Sample.	Sp. gr.	Sulphur Content. Per cent.
1 ..	0·936 ..	2·85
3 ..	0·938 ..	3·12
4 ..	0·942 ..	2·93
5 ..	0·941 ..	2·91
6 ..	0·942 ..	2·93

Specific gravities were ascertained by the use of a pyknometer and sulphur contents by combustion of the oil, with oxygen, in a bomb. Samples four and six appear to be identical.

TABLE VI.

Analyses of Gases from Steam Distillations.

Gas	No. 1.	No. 3.	No. 4.	No. 5.	No. 6.
			Per cent.		
CO_2-H_2S	—	47·88	48·91	54·33	51·66
Combustible gas ..	—	50·50	47·09	41·51	43·63
Nitrogen	—	1·63	3·99	4·17	4·71
Totals ..	—	100·01	99·99	100·01	100·00

The analyses given above indicate that the gas has a very low fuel value.

Light Spirit.—The several light spirits scrubbed from the gases possessed offensive odours. The five samples were united and the specific gravity of the whole was found to be 0·802.

Examination of the Crude Oil.

As previously mentioned, a two gallon sample of crude oil was taken from one of the tanks at Kilve. This oil was produced by the distillation of shale in a vertical retort similar to the type used in Scotland, the throughput of the plant being 2½ tons of shale per day.

The oil was dark-brown in colour, and was less sweet in odour than that of the Scottish shale.

Table VII. shows the main properties of the crude.

Table VII.

Properties of Somerset Shale-Oil.

Specific gravity	0·9612
Loss to sulphuric acid	Totally soluble
Sulphur content	3·44 per cent.
Water	1·1 „

Distillation.

Detail.	Engler Distillation. 2 drops per sec.	New Standard Method to dryness.	
Initial boiling point	85° C.	85° C.	Totals.
	Per cent.	Per cent.	Percent.
Fraction below 100° C.	0·5	—	—
„ 100°–125° C.	1·0	—	—
„ 125°–150°	2·5	2·0	2·0
„ 150°–175°	4·0	—	—
„ 175°–200°	5·5	7·3	9·3
„ 200°–225°	11·0	—	—
„ 225°–250°	17·0	15·0	24·3
„ 250°–275°	25·0	—	—
„ 275°–300°	34·0	20·3	44·6
„ 300°–325°	40·5	—	—
„ 300°–dryness	cracking	46·0	90·6
		Loss	9·4
		Coke	8·65

In the above tests, loss to sulphuric acid was determined by agitation of 25 c.c. of oil and 25 c.c. of 98 per cent. sulphuric acid for 15 minutes on a mechanical shaker: sulphur content by combustion of a known weight of dry oil, with oxygen, in a Mahler-Kröker bomb: and distillations by distillation of 100 c.c. of oil in an Engler flask of standard dimensions. It is interesting to note that the new standard method of distillation (see Standard Methods of Testing of Petroleum and its Products, 1924), gives consistently higher yields of distillates than are provided by the earlier method.

Examination of the Fractions.

The respective fractions obtained by the distillation of two 100 c.c. batches of the crude oil were united and the following table indicates their main properties.

TABLE VIII.

Properties of the Fractions of Crude Oils.

Fraction.	Boiling Point Range.	Sp. gr.	Sulphur. Per cent.
Light naphtha ..	To 150° C. ..	0·807 ..	1·95
Heavy naphtha ..	150°–200° C. ..	0·852 ..	2·69
Light kerosene ..	200°–250° C. ..	0·888 ..	—
Heavy kerosene ..	250°–300° C. ..	0·925 ..	—
Heavy distillate ..	300° C. to coke ..	0·973 ..	2·80

The distillate above 300° C. was analysed for its content of paraffin wax, but only a trace was obtained.

DISTILLATION IN BULK.

Having determined the proportions of light and heavy naphtha, light and heavy kerosene and heavy residue contained in the crude oil, the next step was to fractionate the oil in bulk. This was carried out in a two-litre copper distillation flask in litre batches, five distillations being effected and the several fractions collected according to the results given by the Engler Distillation, first method. The light and heavy naphthas were taken off without steam and the two kerosene distillates with steam superheated to between 180° and 200° C. Each crude fraction was then dealt with as follows:—

(*a*) *Light Naphtha.*—The whole was redistilled, without steam, through a 15-in. rod and disc fractionating column until the thermometer registered 150° C. The temperature was allowed to fall 20 degrees and distillation continued to 150° C., this process being repeated until no further distillate passed over.

(*b*) *Heavy Naphtha.*—The crude heavy naphtha was added to the residue in the flask and distilled through the same column. The portion passing over below 150° C. was added to the light naphtha, distillation continued to 200° C., cooling and re-heating repeated several times and the final residue added to the light kerosene.

(*c*) and (*d*).—The light and heavy kerosenes were not re-distilled. A 100 c.c. sample of each was, however, submitted to an Engler distillation and it was established that the cuts at 250° C. and 300° C. respectively had been well carried out, the final boiling points of the respective liquids being less than two degrees from those required.

(*e*) *Heavy Residue.*—The residue boiling above 300° C. was distilled to coke, in steam, in an iron still, there being recovered 88 per cent. of distillate and 8 per cent. of coke, the loss being 4 per cent.

Refining of the Distillates.

Refining of the first four distillates was effected by agitation with 98 per cent. sulphuric acid, followed by water, alkali and water washes and a final distillation. The quantity of acid employed was 4 per cent. for the light and heavy naphthas and 5 per cent. and 6 per cent. for the light and heavy kerosene distillates respectively. The acid was used in two portions and agitation on a mechanical shaker carried out for a period of 90 minutes with each batch of acid. The time allowed for settling after each wash was 90 minutes, these periods of time being also applicable to the water and alkali treatments. The proportions of acid employed were somewhat high, but the natures of the various fractions necessitated drastic treatment, the heavy kerosene especially being stubborn The refined light naphtha was water-white, and has retained its colour completely after standing in the laboratory for over a month. The other refined fractions, however, were less satisfactory, the heavy kerosene especially having given disappointing results in that it was black after refining, and has become progressively worse in storage.

The residue above 300° C. after distilling to coke was not refined. It was found to contain only a trace of paraffin wax.

Details of yields and properties of the refined distillates are given below.

Table IX.

Yields and Properties of Refined Products.

Fraction.	Yield on original oil. Per cent.	Refinery losses. Per cent.	Sp. gr.	Sulphur. Per cent.
Light naphtha ..	1·10	46	0·778	2·06
Heavy naphtha ..	2·20	27	0·816	2·52
Light kerosene ..	9·90	26·8	0·845	2·33
Heavy kerosene ..	8·80	48·7	0·884	2·65
Residue (unrefined)	—	—	0·973	2·60

We wish to place on record our sincere thanks to Dr. Forbes Leslie and his Directors for their kindness in allowing us to visit the property and take samples, and to Messrs. F. Lawrence, H. A. Stanley, F. H. Price and G. F. Payne, who have carried out a considerable portion of the analytical work described in this paper.

In conclusion, the authors wish to make it perfectly clear that the methods employed in the investigation are standard tests ordinarily employed for comparative purposes of a scientific nature, and are not necessarily indicative of the possibilities of exploitation on a large scale. In fact, a full idea of the potentialities of the shale deposits can only be gained when samples from various parts of the Field have been obtained and their oil, gas and ammonia yields ascertained.

DISCUSSION.

The Chairman, in opening the discussion, said that one point to which he wished to direct attention was the perpetuation of the old system of returning "proximate" analyses for oil-shale. He really could not see that they afforded any information of any value whatever in judging of the quality of oil-shale. He supposed it originated in some old assayer being asked something about oil-shale, and the only knowledge he possessed was that it was probably a bituminous material which could be treated like coal. The figures, not only in the papers under discussion but in the literature on oil-shale and in other papers on the subject, showed that there was no possible relationship between proximate analyses and oil-yield. Taking the figures in Table II. (volatile matter less carbon dioxide) and those for the maximum oil-yield in Table IV., we have :—

Sample.	1.	3.	4.	5.	6.	Scottish.
Volatiles ..	9·01	12·55	6·63	10·56	12·16	18·82
Oil yield	6·88	8·59	10·12	5·00	10·40	22·40

There is not the slightest connection between the two, so what earthly use are such figures ?

Dr. W. R. Ormandy, referring to the Somerset paper, said that, when he looked at the end of it and saw that the proposition did not appear likely to be a commercial one, and saw that the little oil which was produced lost half in refining, he was sorry to say his commercial instincts overcame his scientific instincts and he lost interest.

There was no necessity to discuss the first portion of the first paper, which was a very admirable précis of material which had been laid before the Institution at very great length in almost all its aspects. But the work which had been done at the Birmingham University was in an entirely different category. It was, indeed, interesting to find that Birmingham was now taking up the action of hydrogen under pressure on coal and oil, and had arrived at the stage which Bergius left some years ago. He desired to point out that there were three variables which had to be taken into consideration—namely, pressure, temperature and time. The number of possible combinations of pressure, time and temperature when dealing with possible temperature variations from 400 to 500° C. and pressures of from 100 atmospheres to 250 atmospheres, left an opening for research which would certainly keep Birmingham and one or two other universities busy for a few years to come. It led him to say also that it was not fair to draw any deductions from results that were obtained from what was, after all, a very cursory examination. To start with, Birmingham seemed to have found considerable difficulty in converting coal into oil without the help

of certain solvents. Among many investigations he desired to give the members the result of an experiment carried out on South Yorkshire slack containing 1·3 per cent. of moisture, 5·4 per cent. of ash, 61·9 per cent. coking value and 31·4 per cent. of volatile matter, which, treated under the requisite conditions of temperature, pressure and time gave a conversion of the coal substance, reckoned free from ash and moisture, of 66·8 per cent. converted into oil, that being called oil which was soluble in benzol. Fifteen point six per cent. of the coal substance was unchanged. As a matter of fact, however, that so-called unchanged material, which under the microscope looked like coke, was not unaltered coal in small particles, but gave to other solvents a good deal more than half its weight. It could not really be called unaltered coal; it could merely be said that it was altered coal, not an oil. He thought, quite rightly, the Birmingham school directed their attention to the integral constituents of coal, clarain, durain, fusain and so on. He was able to agree with one point in the paper he was glad to say, namely, that fusain was comparatively little acted upon under the same conditions as caused the other three constituents to be acted upon. He desired to make it quite clear that he was not saying that fusain could not be converted by means of hydrogen under pressure into liquid constituents; he was merely stating that the comparatively narrow range of conditions under which the other constituents went into oil were not suitable for it, but there might be other conditions which were capable of converting fusain into a liquid. From samples which were very kindly provided by the Fuel Research Board for experiment, fifty per cent. of the durain was converted into oil; of the fusain 22 per cent.; of the clarain 71·6 per cent., and of the vitrain, 77·5 per cent. The amount of insoluble organic matter, which he again emphasised was not unaltered coal, and was largely soluble in some solvent, was respectively 31·8, 76·5, 7·48 and 9·12. In the case of vitrain, although the oil produced was only 77·5 per cent. on the dry ash-free material, the residue was 9·12. The water, the nitrogenous products and the ash had to be taken into consideration. He thought it could be said beyond all possibility of doubt, from the experiments that had been done in Birmingham and elsewhere, that there was no question but that hydrogen was an important and a vital constituent for the conversion of coal into oil if anything like an adequate yield was to be obtained. On the other hand, he thought it was sometimes good in chemistry as well as in philosophy to define terms. The authors had spoken of hydrogenation and dehydrogenation. Personally he would hardly call pyrogenic decomposition a dehydrogenation in the ordinary sense in which that word was used in chemistry at the present time. What

happened, apparently, was that the coal under those conditions of heat and pressure was subjected as usual to pyrogenic decomposition, and that certain gases, methane, hydrogen and so on, were given off during its decomposition, and that in some way those linkages which would be present in the unsaturated bodies which were formed during ordinary decomposition in the presence of nitrogen were, by the presence of hydrogen, saturated, because the fact remained that the volatile constituents—*i.e.*, the constituents boiling up to about 160° C. taken out of the gases given off from Berginisation, forming 10 gallons to the ton of the coal treated, contained practically no unsaturated bodies. They had a bromine number of about 1·5 grammes per 100 c.c. The authors had stated that little was known about those products, and that was, of course, true. They were at present only to be got at one place; but he could state that the volatile matter which was extracted from the gases by charcoal and then steamed out, boiling between 25° and 160° C., yielded about 1½ per cent. to caustic soda, and after washing with a 10 per cent. solution of caustic soda the residue had a bromine number of 1½, the paraffin content was about 30 per cent., the aromatics 18 and the remainder were naphthenes. Although one would have expected to find hexahydrobenzene and hexahydrotoluene, very little of those bodies appeared in the samples investigated. Nevertheless, the product was a valuable one from the motor point of view, in that the percentage of paraffins which would not stand high compression was low, and these were for the most part the volatile portions, chiefly pentanes, which withstood a higher compression than the heavier homologues. The authors further stated that they thought it was desirable to make use of phenol in that it exerted a solvent action on coal, and that better results were obtained in using phenol as a solvent. Experiments had been made using the tar-oils produced in the process itself from which the phenols had been washed as the medium for mixing with the coal. The medium for mixing with the coal was not added in order that the reaction might be more complete; it was merely added because the only mechanical method that could be seen for getting coal in quantities continuously into a retort under a pressure of 1½ tons to the square inch was to introduce the coal in the form of a paste or fluid. The result had been to show that there was very little difference indeed, whether the phenol fraction washed out of the product itself, boiling between 250° and 350°, was used as the medium for introducing the coal, or whether a similar fraction was used from which the phenols had already been taken out. Finally, he wished to say that it was a feasible proposition at the present time to convert average British bituminous coal to the extent of something like 90 per cent. on an average of the coal substance

into oil consisting as to 20 per cent. of petrol fractions boiling below 180, the next 20 per cent. being Diesel oil, and the remainder heavy fuel oil or pitch. The nitrogen was converted as to one half into ammonia and the other half into pyridine-like compounds. The pitches produced were very extraordinary, and, from the very high boiling-point fractions, there seemed every evidence that lubricating oils of quite considerable value would be extractable. The time had gone past for doubting the possibility, but, as Dr. Dunstan had often pointed out, it was a mistake to say that the Berginised oil resembled mineral oil. It was impossible to say that an oil which contained 20 per cent. or 25 per cent. of material phenol-like in character and soluble in caustic soda was like petroleum, but it could be said that, having extracted the bases and removed the phenols the residual oil then left did resemble mineral oil.

The Chairman said he owed some apology for the fact that the two papers were taken together. One important reason which weighed with him in agreeing that the two papers should be taken together was that it was the wish of the authors, and, in the second place, he thought personally that if either paper were taken first the discussion would probably last so long that there would not be time to read the second paper at all.

Mr. N. A. Anfilogoff said that he did not feel very despondent that oil was going to disappear. Nevertheless he thought it would be very interesting to discover from the papers where posterity must look to for its future sources of fuel. Dr. Ormandy had intimated that Dr. Bergius was going to hydrogenate coal and then produce fuel. He did not forget that this country passed through four or five years of war between the time when Bergius first introduced the hydrogenation of coal and the present day. War time experiments showed at least how little this country could depend upon coal for its future fuel oil resources. A year or two ago certain gentlemen advocated that the fuel oil supply should be increased by means of a process using powdered coal. All those things were hardy annuals. During the last 30 years he had met many people who had said that oil was petering out; but history had proved that, even when a large oilfield had suddenly petered out, a larger oilfield producing more oil still had been discovered, and as a result more oil was being produced now than then. In his opinion, posterity would look after itself.

Mr. E. H. Cunningham Craig said he did not wish to enter into a discussion in regard to the Berginisation of coal, except to suggest that a great deal would be learned if those making experiments would make them with coals in which there was a large quantity of what had been known as jetonised material,

i.e., material which had hardly reached the coal stage. If material of that kind, which could be obtained in cannels and in brown coals, were used, and also if torbanites were used, very interesting results would be obtained. There were one or two small points in the papers into which he was afraid some inaccuracies had crept. For instance, Prof. Nash said that the oil-shales in America ran as high as 90 gallons per ton. Personally he did not think there was any oil-shale in America which went near to 90 gallons per ton, but there were torbanites that went to that figure and more. The authors also stated that in France the yield was from 80 to 120 and in Australia even more from oil-shale. Those figures again referred to torbanites and not to oil-shale at all. He was very glad to see the conclusions at which the authors had arrived with regard to the distillation of torbanites and cannels. Very much the same conclusions were arrived at in the Petroleum Research Department and in the Cannel Coal Committee appointed by the Institution a few years ago. The Committee went perhaps a little further because it classified the various cannels and coals, and suggested the way in which they should be utilised both for making solid smokeless fuels out of the residues, and for making the best kind of oils. On those questions he thought that portion of the paper was hardly up to date.

Mr. Gordon Pitt said that, although he was in general agreement with Dr. Ormandy as to the enormous future potentiality of Berginisation, at the same time he was in agreement with Mr. Anfilogoff that for the immediate present natural resources of oil were likely to give the world the greater part of such supplies as it required. None the less, the fact remained that in an important country such as our own, low-temperature carbonisation or some such immediately available method for the production of large quantities of usable oil had a very important bearing. In that connection he felt it advisable to draw attention to the seriously misleading figures put forward in the paper on the authority of His Majesty's Fuel Station. They had simply been repeated by Prof. Nash and his collaborators. Although 7¼ gallons per ton was given as the largest amount of oil procurable from a coal of the analysis given, he wished to say quite definitely, that as the result of some four years' investigatory work which had been concentrated rather closely into the last eight or nine months, and, particularly, definite tests for 17 consecutive days which he had recently had the opportunity of seeing on a so-called low-temperature carbonisation process, he was now in a position to state that from a coal of that nature at least 30 to 35 gallons of oil per ton of coal could be assured. That oil was divisible by simple fractionisation into from 10 to 20 per cent. of motor

spirit; from 40 to 50 per cent. of straight run Diesel fuel; and the balance was an excellent furnace fuel oil. There was no appreciable pitch in the oil and the gas losses had been almost eliminated. He thought it was advisable that figures of that nature should appear in order to modify possibly misleading impressions which might be given by those appearing in the paper.

Mr. J. E. Hackford said he wished to draw attention to the statement made that the analytical determinations referred to in the paper on "Somerset Oil-Shales" suggest the unsuitability of the spent shales for employment in cement manufacture. From this point of view he had been asked the question not long ago whether shale or its residues could be made into a cement, and whether the oil in the shale could be used as part of the process at its face commercial value without the necessity of extracting it. His answer was in the affirmative, and he had brought with him for the inspection of the members a few samples of cement so made which complied with the specifications of the British Engineering Standards Association.

Mr. J. G. King said the question of the production of fuel oil by the "hydrogenation" of coal in the way described in the papers was a difficult one from many points of view. Surely the question of the coal resources of the country so far as the future was concerned was just as important as its oil resources, and if the oil of the future was going to be produced from coal, the coal resources of the country would suffer. He did not think the authors had discussed this point of view sufficiently. One other point he desired to mention. At the Fuel Research Station the experimental work on low-temperature carbonisation had led to the publication of certain figures, which had been quoted in Prof. Nash's paper, and to which exception had been taken by one of the speakers. He wished to say that those published figures for tar yield were in agreement with the results published by other workers, namely, that about 15 gallons of tar were obtainable from bituminous coal by low-temperature carbonisation. From those 15 gallons about 8 gallons were recoverable as refined fuel oil of different kinds by distillation processes, the difference between refining losses and pitch. By tar separation processes the yield of refined oil might be increased to 12 gallons per ton, but no such process had yet been successfully applied to the treatment of low-temperature tar. No other carbonisation process had yet been proved to produce more than 18 gallons of tar per ton of coal. Although many schemes had been put forward to produce as much as 33 gallons per ton of coal, none of these had ever borne investigation, and he therefore thought it was hardly right for

anyone to make an unsubstantiated statement to the effect that the Fuel Research figures for tar yields were wrong. This was not so, and the yields quoted represent those obtainable, under the present conditions of low-temperature carbonisation, from an *average* bituminous coal. He was of the opinion that Mr. Gordon Pitt should not make such statements until he was in a position to describe in detail the plant he had mentioned and at the same time to produce the associated experimental evidence.

Mr. Gordon Pitt, in reply to Mr. King's remarks, said that he was prepared with ample evidence in support of the figures he had quoted, and it was simply out of consideration for the audience and the lack of time available for discussion that he did not put them forward in his previous remarks. He felt that the rather misleading low figures which were quoted in this paper should, if possible, be modified if information was available. He desired, however, to cast absolutely no slur whatever on the work of the Fuel Research Station.

The Chairman said that every opportunity would be given by the Publication Committee for the consideration of Mr. Gordon Pitt's figures, and they might be included in Mr. Gordon Pitt's remarks if he would send them to the Institution.

Mr. Gordon Pitt said that that was his intention.

In extension of the above remarks, it will perhaps be sufficient only for the moment to add the following brief particulars for present publication, as the writer hopes shortly to have an extended opportunity of observing the process referred to working on a full commercial scale. When the much more extensive data obtained thereby are ready, it is hoped to submit them to the consideration of the Publication Committee.

The process by which the results roughly summarised in the figures given have been obtained has been undergoing private development for the last ten or eleven years, and very little information regarding it has as yet been made generally available. It embodies a physical principle which appears so far to have been overlooked or disregarded by other low-temperature carbonisation processes, and the application of this principle ensures that the evolved hydrocarbon vapours are never, after the moment of their release from the solid material—which release is also arranged to take place at somewhere near the critical temperature best suited to it—exposed to a temperature in excess of that at which they are generated. This, *ipso facto*, would be expected to minimise cracking, and, in actual operation, cracking appears to have been almost entirely eliminated. The method of heating is by direct contact of the solid material with steam at low pressure (not over 5 lbs.

per sq. in. above atmosphere), and a high superheat (some 600° C. at admission). This method renders temperatures and the rate of heat transmission to the solid extremely simple of control, especially as the rate of travel of the solid through the retort is separately and easily governed. The steam and evolved hydrocarbons are removed from the retort at a temperature not much over 100° C., under which conditions the oil exists largely as a mist of liquid particles carried in the stream of steam. Condensation and separation of the oil and water have presented no difficulties. The elimination of cracking and the general conditions of generation result in the production of an oil of markedly higher grade than that usually associated with the idea of low-temperature carbonisation of coal and the absence of cracking is substantively proved by the fact that practically no detectable quantity of uncondensable combustible gas can be found coming from the retort. The exclusion of air from the retort is also an important feature in the reduction of the quantity of oxidised products in the oil.

The remarkably low operating cost of the process is due partly to the extremely simple and practically automatic nature of the plant, and also largely to the use of steam as the heating medium, as this lends itself so readily to heat recovery at a later stage of the process.

The results already mentioned are a general summary from a large number of tests made in a small commercial sized plant with a daily capacity of 15 to 20 cwt. of bituminous coal. Those which it is hoped to give later will be from a full-sized commercial unit of about twelve times this capacity. This small plant has also been used for a large number of tests on oil-shales, cannel coals, and a variety of other bituminous materials, all of which have given corresponding highly satisfactory results.

Referring to the above, Mr. J. G. KING has written as follows :— These additional particulars do not alter in any way the statements I have already made. The process which Mr. Pitt describes is not yet a commercial one, and until working figures, obtained on a large scale, can be produced in support of his statements, I feel that the present position of tar yields from low-temperature carbonisation must remain as quoted in Prof. Nash's paper. It is understood that the yields quoted are for average bituminous coals and may easily be exceeded when specially suitable coals are treated.

The principle involved in Mr. Pitt's method is already a well-known one, and 24 gallons of tar per ton can be obtained from average coal in the laboratory by its use. Whether this can be translated to large scale practice remains to be determined.

I am not in agreement with Mr. Pitt as to the nature of the tar produced, but I do not consider that this is a suitable occasion

to go more fully into the matter. One point which should be brought out, however, is that the quoted figure (Professor Nash) of 7·25 gallons of oil refers to *refined oil*, and Mr. Pitt's figure of 33 gallons to *crude tar*.

Mr. G. Howell desired to mention one point with regard to Esthonia. By agreement with the Royal Geographical Society the letter "h" had now been dropped from the word Esthonia, and that part of Europe was now known as Estonia.

Mr. J. F. Ward thought the authors should have taken more samples than they did from the various oil-shale seams in Somerset. During the last three years samples of Somerset shales had been sent to him which showed volatile hydro-carbons varying from 6 per cent. to as much as 20 per cent., with corresponding oil yields. Not only did volatile hydro-carbons vary in amount, but also other constituents. For instance, the sulphur content varied from 1·5 to as much as 3·8. He had been particularly interested in the author's statement that the oil was completely soluble in sulphuric acid. Two years ago he particularly wanted some oil of that nature. The oil obtained not only did not dissolve in strong sulphuric acid, but would not even dissolve in oleum. About two months later he received a sample of a totally different class of oil which contained a very much higher percentage of unsaturated hydro-carbons. From the various samples that had been sent to him the fact had been very strongly brought home to him that to lay down any definite statement as to the best method of extracting oil from Somerset shales was hopeless, and he therefore advised the various people who had approached him that it would be better to utilise the volatile hydro-carbon that was present as an auxiliary fuel. Further, an analysis of much of the shale indicated that it would be a suitable material for cement making. Further, from the spent shale most excellent tiles had been manufactured. He also wished to point out that there was another limestone formation in this area which yielded lime of 99 per cent. purity. In his opinion it was doubtful whether oil could profitably be extracted from the low volatile Somerset shale unless there was a large amount of waste heat available whereby the oil could be obtained for nothing. Whether in the manufacture of the cement to which he had referred these would be considerations which would enable the extraction of the oils to be profitable was a matter which only the future would disclose. It had been shown that the volatile hydro-carbons in the material could be utilised, the finished products made from the spent shale and lime stone had been inspected, and it was found that they answered all requirements and tests.

Dr. V. Henny said there was one statement in the paper on the Oil Resources of the Future which he thought practical oil men would not completely agree with, namely, "With ordinary pressure cracking methods a certain amount of synthetic motor spirit can be obtained from some oils, but the residuum is less limpid and in some instances has to be mixed with a lighter fuel oil to render it less viscid: as this difficulty is fundamental, it cannot be overcome by the present methods." He felt sure that that statement did not refer to more modern cracking plants but only to the old-fashioned batch processes. It is very well known that cracked residues were much more liquid than the original charging stock, as Dr. Dunstan had also mentioned in his paper on cracking. In the very great majority of cases the cracked residues have a lower viscosity and are far more liquid. Furthermore, there is a cracking process in operation at present which does not make any residue at all. Either gas oil or fuel oil are converted directly into a pressure distillate which is composed of petrol and a cracked gas oil which can be used again for cracking, and it only differs from ordinary gas oil in that it is more unsaturated. If Berginisation would help to produce a large amount of oil he suggested that the work of Prof. Maihle in France with regard to hydrogenation of all kinds of vegetable oils might have been mentioned from the point of view of the future supply of oil.

The Chairman said that owing to the lateness of the hour he was compelled to close the discussion and ask Prof. Nash briefly to reply. To most of the discussion which had taken place the authors would reply in writing, as they also would to other members of the Institution who would no doubt contribute written remarks to the discussion.

Prof. Alfred W. Nash, in reply, said he quite agreed up to a point with the remarks made by the Chairman with regard to the analyses. Dr. Ormandy had, in the course of his remarks, quoted a figure of 66 per cent., but it must be remembered that that was on an ash-free, dry basis. The figures given in the paper related to natural coal, and consequently the yields on an ash-free, dry basis will be higher. The authors were quite aware that Dr. Bergius did his work many years ago, in fact it was through Dr. Bergius's investigations that the work had been commenced in this country. He quite agreed with Mr. Cunningham Craig's remarks. As a matter of fact the authors were experimenting with lignite at the present moment, but the results were not yet forthcoming. He also accepted Mr. Cunningham Craig's statement in regard to torbanites. The remarks Mr. Ward and Mr. Hackford had made

with regard to the commercial possibilities of Somerset shale did not interest the authors in the least. The paper was not put forward in the interests of working shale or against the interests of working shale: it was simply put forward as a paper containing details of a scientific investigation. The samples that were used were taken on the advice of two of the directors concerned in the Somerset shale oil proposition: they were taken from where the quarrying was being done under the supervision of the officials mentioned. He quite agreed with the remarks of the last speaker (Dr. Henney), that the question of hydrogenation of vegetable oils should have been mentioned.

On the motion of the Chairman, a hearty vote of thanks was accorded to the authors for their papers, and the meeting terminated.

The following contributions to the discussion were subsequently received.

From Mr. E. H. Cunningham Craig:

Somersetshire Shales.—I examined some picked specimens of these shales about 18 months ago, and found them calcareous and very poor in oil. I am glad that the very careful investigation conducted by the Authors has entirely confirmed my own observations. The specific gravity of the material is enough to condemn it at once, since its weight is due to the presence of carbonate of lime in large quantity. No argillaceous rock containing such a high percentage of lime can be sufficiently colloidal to absorb petroleum to such an extent as to deserve the name of oil-shale. There are other oil-shales that contain large percentages of lime, *e.g.*, the Esthonian shales, but in such cases the lime occurs as fragments of fossils, and is not disseminated through the matrix as in the case of the Somersetshire shales. In fact, no one but a confirmed optimist would employ the term oil-shale to describe these Somersetshire deposits.

From Mr. G. Howell:

In respect to the potential future resources of crude petroleum oils, I would suggest that there will be found ample new fields, which with present fields, will dissipate all anxiety for future demands.

The crude oil production of the United States for the last five years has been recorded, ranging from 377,719,000 barrels in 1919 to 724,000,000 (estimated) in 1924. But the American producers to-day suggest that 1925 production will be about equal to the apex year of 1923 (725,702,000 barrels).

Persia offers even more striking figures of an increasing oil production, than in the past, as is clearly ascertained from the following table :—

	Tons.
1918–1919	1,106,415
1919–1920	1,385,301
1920–1921	1,743,557
1921–1922	2,327,221
1922–1923	2,959,028
1923–1924	3,714,216
1924–1925 (estimated)	4,500,000

and, if the market warrants, this production can easily be brought up to 10,000,000 tons.

No mention, however, was made in the paper to Russia as a potential oil producing country, for the Russian production has gone steadily up, as is shown by the following table :—

Russian Crude Oil Production.

	Tons.
1922	4,888,700
1923	5,213,500

and 1924 is expected to exceed 1923. These last figures were compiled from official sources.

From **Mr. J. C. Templeton :**

In comparing coal with petroleum, I think the chief difference lies in the fact that coal, where developed in commercial quantities, is over larger areas than is the case with petroleum deposits. Furthermore, the coal industry is not subject to the same fluctuating factors as are present in the petroleum industry. For example, there are no incidents in coal, so far as I know, such as we have in the Mexican oil fields and elsewhere where thousands of tons of oil are being produced one day, and, with little warning, nothing but water the next day. It is, I think, such factors which give rise to the latent fears which seem to be always present in the mind of the public whenever petroleum is discussed.

There are a few points raised by the Authors in their paper "Fuel Resources of the Future," which I should like to deal with. I should like to know :—

(1) which of the theories as to the origin of petroleum is the commonly accepted one, and

(2) does any one of the theories advanced help us as to whether or not petroleum deposits are still being laid down.

I do not agree with the authors when they state that the Engineering branch of petroleum technology has made the most progress and has fewer problems to solve than the other branches of the industry.

In my opinion, all branches have their hands full of immediate problems awaiting solution, and the Engineers no less than the others. Fields Engineers are often asked why they do not get away from the position that many of the present day fields tools and methods are only modifications of those used by the Chinese in the year 1800.

Then again, I think the authors are unduly pessimistic as to the efficiency of petroleum geology. That the present day degree of inexactitude will be greatly reduced in the future I have not the slightest doubt, and it chiefly rests with the training schools such as Birmingham to turn out young geologists who have been well grounded in pure science and who will therefore be able to appreciate the application of whatever scientific discoveries are made. The Torsian Balance, Magnetic Surveying, etc., etc., are a few instances of how the present-day petroleum geologist is looking for scientific aids.

With reference to the authors' advice to oil prospecting companies to send with each geological party a drilling party, I am not clear as to whether they contend that such a scheme should be carried out with every geological party or only in specific cases where surface evidence is lacking or where considerable gaps exist in the geological evidence available. If their proposal means the drilling of small diameter deep bores—I have heard of such a proposal elsewhere—then I disagree with them, particularly on the point of cost. In my opinion it is just as expensive to deep drill for geological evidence as to deep drill for evidence of oil. Often in new areas one finds ideal structural conditions with ample evidence to support the recommendation to drill. Yet when the drill has tested these areas it is found either that lateral variation in the vital beds has made the area useless, or that porous formations are present but no petroleum. If, however, the authors advocate the use of shallow drilling outfits, hand shafts, etc., where geological evidence is deficient, then I can fully endorse their proposal. I recollect one case in point where nearly four months' shallow drilling was necessary in order to establish the axis of a particular asymmetrical anticline. At this part for a breadth of nearly two miles the older rocks were overlaid by recent gravel deposits to a depth of some 80 feet. In such cases, or in cases where there are considerable gaps in the surface evidence, the obvious thing to do is to drill for the evidence required. Small, portable rotary or percussion flush outfits driven by 4 h.-p. Diesel or benzine motors are on the market, and are certainly a valuable aid to any geological party in certain circumstances. The chief factor, however, which influences oil companies in their consideration of exploration programmes is the cost of drilling, and it is the cheapening of this factor more than any other which

will decide the extent to which any oil company will explore. This is one particular problem which lies purely within the province of the engineer.

When one considers it is only the drill which can test an area, and that exploratory borings may cost anything from £3 to £30 per foot drilled, it is not to be wondered at that oil companies hesitate at undertaking large exploration programmes.

From **Mr. G. W. Halse:**

The present colossal world-wide oil business is the direct descendant of retorting for oil, which was commenced on a commercial scale in 1850. Drake's immediate success in the United States in 1859 was due to the fact that having obtained oil by drilling specially for it, he found a ready sale for it in the growing markets already established by the 53 retorting companies operating in that country at the time.

Had the demand for oil not been first created by the supplies from retortable materials, the commencement of the present oil cycle, the cycle of so-called free oil, might have been deferred for years.

The important point to note in history is that while the supplies of oil from drilled wells put the retorting installations as such out of business (they were mostly transformed into refineries) in the United States, those in Scotland have functioned continuously up till the present time. The fundamental reason for this difference, without entering into the question of sulphate of ammonia, is merely that in a country without its own supplies of oil from wells, retorting can be made a success. And this historic fact is the key to the future. Those countries which have no indigenous oil, and are far from producing countries, but contain rich shales, torbanites or similar materials, will afford a profitable field for rejuvenating retorting for oil. It is therefore the duty of technologists, in view of the immense importance of increasing supplies of liquid fuel, not only to continue active research, but to keep before the public the vast and certain resources of liquid fuel stored and readily available in these materials in many parts of the world.

From **H. V. Mitchell:**

Fuel Oil Resources of the Future.—The availability or the exhaustion of the world-supplies of petroleum in the future in no way affects the blunt truth that Great Britain cannot, without economic extinction, become to any great extent a fuel-importing country.

In this connection the low-temperature carbonisation of low-grade coals must be afforded all the attention it merits.

Admittedly, research upon low-temperature lines has been tedious and costly. As an offset to the rather large sums of money

that have been expended, much solid progress has been made. The mechanical difficulties encountered—and they have been many—have been overcome to such an extent that at Barnsley the low-temperature carbonisation of coals may well be said to have passed the experimental stage, in so far as any process at all may be said ever to pass experiment by.

At all events, here the process is in continuous operation in retort battery-units each dealing with 50 tons of coal per diem, week after week and month after month, in a thoroughly practical manner. The demand for the semi-coke or smokeless fuel is enormously in excess of the output, notwithstanding the high cost of relatively small-scale production being reflected in the price charged to consumers. In the discussion following Dr. C. H. Lander's paper upon this subject, read recently before the Liverpool Engineering Society, it was stated quite definitely by Mr. P. C. Pope that with a plant carbonising a thousand tons daily, the resulting fuel could be marketed, if need be, at twenty-five shillings per ton.

The writer has been privileged to superintend the carbonisation of many thousands of tons of coals from various sources upon this plant; and in his mind there is no doubt at all as to the complete practicability of the process.

This is strikingly confirmed by the very strict and exhaustive practical test carried out in July last by the experts of the Fuel Research Board, the results of which have been published by the Department of Scientific and Industrial Research. The report confirms every claim that has been made regarding the performance and the capacity of the present installation.

Messrs. Nash and Shatwell state in their paper that low-temperature tars contain no lubricating fractions. This statement is much too sweeping; and, with many coals, is not in accordance with fact. The writer is perfectly ready to admit that as far as the work at present done can indicate, the lubricants obtainable from coal may not equal in quality those obtainable from many crude petroleum oils. But lubricants of a kind are certainly obtainable, and when the necessary research work in this direction has been prosecuted, their quality will doubtless be much improved. It must not be forgotten that practically the whole of the scientific work in this direction remains to be done, particularly large-scale distillation and refining operations which alone can afford really reliable data and give fair treatment to the products.

Regarding the lighter materials obtainable from coals at low temperatures, there is no room for doubt as to their excellence for the purposes which their natures indicate.

The spirit scrubbed from the gas, after no heavier acid refining than is allowed many straight petroleum spirits, yields a "petrol"

(not to be confused in any way with benzol) which compares most favourably indeed with any petroleum spirit obtainable—and this in amount not less than 80 per cent. of the crude gas spirit.

As independent evidence of this, very satisfactory reports from the laboratory and the testing department of the "Rover" Motor Company are of particular importance, especially in view of the fact that the material submitted was the very first batch to be put through a new rectifying plant.

Dealing now with the tar-oil, Messrs. Nash and Shatwell set down the yield at 14 gallons per ton of coal. This figure is considerably lower than that actually obtained upon regular large-scale working. Taking the variations of many different types of coal into account, this figure may safely be placed at 18 gallons, and higher yields are by no means unusual.

These tars are rich in "cresylic acids," which amount upon the average to some 17 gallons per 100 gallons of tar. Upon fractionation these do not begin to distil until the boiling point of phenol is passed, even ortho-cresol being practically absent; the distillation proceeding briskly round the boiling points of meta and para cresols. Low-temperature cresylics are therefore valuable assets from the disinfectant standpoint.

Quoting results obtained by H.M. Fuel Research Board, Messrs. Nash and Shatwell mention that only 50 per cent. of the tar-oil can be utilised as fuel oil. This is misleading, because the tar itself might be used in the raw state, or after simply being denuded of the valuable cresylics; even in the latter case some 80 per cent. would be available as fuel. The immiscibility of the tar with ordinary petroleum fuel oils is admittedly a disturbing factor should it be necessary to change about from the one fuel to the other; but this would cause no trouble were supplies of the tar-oil to be considerable, so that the necessity for admixture would not arise. In any case this question of miscibility is at this moment the subject of careful investigation. Indications are not lacking that before long this hindrance will have been overcome.

Howsoever the matter be viewed, the home production of liquid fuel is rapidly becoming a matter of national urgency; and the materials available for the purpose are our coals and shales. The shales—questions of sulphur elimination quite apart—give higher yields of oil; but coals give a solid smokeless fuel in lieu of a worthless spent shale, and something over 3,000 cubic feet of very rich gas, for which, again, there is a ready outlet.

The authors subsequently wrote, in reply, as follows:—

The Chairman has stated that the proximate analyses of oil shales were of no value in that they gave but little indication of the oil yielding properties of a bituminous material.

We were quite aware of the fact that relatively they do not convey much information, but it is the generally accepted method of describing such material and the figures serve a useful purpose in confirming the similarity between the Somerset and South Wales shales.

We would inform Dr. Ormandy that our paper was not intended as a full account of the investigations of the Berginisation process; the summary given of the experiments carried out at the Birmingham University were necessarily very brief and we would advise that he waits until the full details of the work are published in the January issue of "Fuel" by Messrs. Shatwell and Graham before he jumps to quite erroneous conclusions.

Although the investigation has occupied less than two years, and other problems have been studied simultaneously by a very small staff, it has been shown that, *contrary to the assertions of Dr. Bergius, a coal containing substantially more than 85 per cent. of carbon can be readily liquefied.*

To the three variables mentioned by the same critic, we would add a fourth, *viz.*, hydrogen concentration, which, in a discontinuous process, is not necessarily the same as pressure.

Dr. Ormandy's claim that 90 per cent. of an average British bituminous coal can be converted into oil, verges, in our opinion, on the extravagant. The yield of liquid (hydrocarbon) products will depend largely upon the oxygen content of the coal, and, in most cases, substantial proportions of uncondensable gas and water will result.

It is obvious, of course, that a complete study of hydrogenation will occupy a considerable time, and in this connexion it is hoped that other research associations will turn their attention to what is a fascinating and fundamentally important problem. Dr. Ormandy's accounts of the liquefaction of a Yorkshire slack and of the macroscopic ingredients of a bituminous coal are of interest.

It would have been of greater interest, and of considerable assistance to workers in this field, to hear from him a detailed account of the exact experimental conditions employed, the percentage of hydrogen absorbed, the volumes and composition of the evolved gases and a description of the method by which the percentage yields of oil products was ascertained, as well as the ultimate composition of the coals used; had this information been given we should have considered Dr. Ormandy's criticisms more constructive.

We note the high yields of liquid, especially from clarain and vitrain, and that the loss of carbonaceous matter in the latter is 13·38 per cent. If this figure includes gas and water formation, it is surprisingly low, and from a commercial point of view, it would be necessary to know the yields of products on the gross weight of coal used, *i.e.*, including ash and moisture.

Further, we do not claim that the use of phenol is desirable because it exerts a solvent action on the coal.

On the contrary, an equally good result was obtained when a gas oil was employed instead of phenol, whilst a blank experiment with phenol showed that only 8 per cent. of the coal was dissolved.

Mr. Angilogoff may rest assured that coal is not the only material which has been, or is being, investigated at the Birmingham University. A wide series of researches is now being prosecuted and several problems already dealt with are not yet ripe for disclosure.

We are studying, or intend to study, the effect of Berginisation of various types of coal from lignite to anthracite, in collaboration with our Mining Research Laboratory, of cellulose, torbanites and shales, of various oil fractions, including asphalt and paraffin wax and of some of the pure hydrocarbons.

The remainder of Mr. Angilogoff's remarks are a reiteration of the statements made at the beginning of the paper, and we are glad to see he is in agreement with us.

Mr. Cunningham Craig is evidently interested from the point of view of origin of the substances he mentions, and the work mentioned in our reply to Mr. Anfilogoff's will throw considerable light on this subject. We agree with his remarks on the Somerset shales.

Mr. Gordon Pitt's description of a new method of low-temperature carbonisation of coal is welcomed, but as no account of the work has been published previously, we are hardly to blame for omitting it from the paper. The figures we have given are based upon the official reports issued by the Fuel Research Board and Mr. King's remarks thereon express our own opinions exactly.

We also agree with the latter gentleman in his reference to the importance of indigenous coal supplies, though our remarks were not necessarily intended to apply to the coal of this country alone, nor to the English type of coals.

We were aware that Somerset shale is regarded as a potential raw material for cement and Mr. Hackford's contribution confirms us in our opinion that, for such a purpose, the shale must be mixed with lime. The lime method applied to the manufacture of bricks from Scottish spent shale is now being tried and the tiles referred to by Mr. Ward are obtained, probably, by an adaptation of this process.

Dr. V. Henny's remarks regarding the efficiency of a particular cracking process are of importance. There is no doubt that the art of cracking has advanced considerably in recent years, but we are not convinced that complete decomposition of a heavy oil to lighter products is possible except by the formation of substantial quantities of coke, so-called, and heavy viscous residues. A mild form of cracking, such as the Auld Dunstan and Herring process,

will undoubtedly lower the viscosity of an oil, but more or less complete cracking is almost certain to give the results indicated. Vegetable oils as a source of mineral oils should have been mentioned in the paper.

In answer to Mr. Templeton's questions we would reply as follows:—(1) The Organic theory; (2) Yes, both the modern inorganic and organic theories.

We were not thinking of field engineering so much when the statement was made that the engineering branch of petroleum technology had made the most progress; we were referring to the Mechanical engineering side of the whole industry generally, and we agree with Mr. Templeton in his remarks on the present-day methods of drilling.

We suggest that an improvement in this direction will occur when more men with a radically sound training are taken into the industry and given their practical training there, in accordance with the practice common to all other industries. No other industry, controlled from this country, sends abroad for much over-rated skilled labour at ridiculously high wages; the apprenticeship system has been one of the secrets of the industrial success of Great Britain, and if young men with adequate specialised training on the theoretical side were given opportunities of practical training in drilling, many of the drillers at present obtained from elsewhere would have to change their vocation as they would not find employment in their own country.

In the main we agree with Mr. Templeton's remarks, and they confirm the views expressed by one of the authors at the Mining Congress, that the Petroleum Industry, if it is to be treated as such, requires a large amount of working capital, which is totally different from authorised capital.

We are obliged to Mr. H. V. Mitchell for his description of low-temperature carbonisation. He accepts in the main our own conclusions, and we certainly agree that the work is only in its early stages.

The Hydrogenation of a Gas Oil.

By H. G. Shatwell, B.Sc.(Vict.) M.Sc.(Tech.), A.I.C.

The high pressure hydrogenation of heavy mineral oils with the object of producing low-boiling hydrocarbons is at present attracting much attention.

The process has been worked out in considerable detail by Bergius, who, in a series of papers and patents, has advanced claims of far-reaching importance, (see E.P's. 18232, 1914: 5021, 1915: 148436, 1920: 192849, 1923: J. Gasbeleucht 1912, 541,748: J.S.C.I. 1913, 462: Z. angew. Chem. 1921, 34, 341—347: Tech. Journ., Min. Soc., Birmingham University, 1923).

Briefly, the method of hydrogenation invented by Bergius consists in heating heavy oils, or coal, peat, lignite and the like with hydrogen to temperatures of 400° to 600° C., and pressures of over 20 atmospheres, the most suitable conditions for oil being temperatures of 400° to 430° C. and pressures of over 100 atmospheres. In the case of oil hydrogenation, substantial yields of saturated motor-spirits are stated to be obtained even from the most unpromising materials, while the residue are useful as fuel oils, gas formation is of a low order and deposition of carbon is negligible.

When solid carbonaceous substances are treated under somewhat similar conditions, hydrogen is absorbed and a viscous liquid produced, the latter, on further hydrogenation, being converted into a mobile liquid which resembles a crude petroleum and from which may be obtained the usual mineral oil distillates. As regards coals, however, the process is applicable only to those which contain less than 85 per cent. carbon (ash-free dry basis), and in many cases, it is claimed that the whole of the carbonaceous matter contained in the coal is readily converted into oil.

Although the work of Bergius and collaborators has continued without intermission since 1912, the difficulties of the investigations are such that, as regards the treatment of coal, complete success has not yet been attained, whereas with oil a commercial process has only recently been put into operation.

The Bergius Process as applied to oil is fundamentally different from any other method of obtaining light fuels from heavy crudes, distillates and residues: and with respect to the liquefaction of coal and other bituminous substances, it marks a new era in the

treatment of such materials and provides a means of throwing fresh light on their constitution.

For these reasons, and on the initiative of Professor Sir John Cadman, K.C.M.G., it was decided to carry out an extended series of investigations on the hydrogenation of coal and oil, first to endeavour to ascertain the extent of applicability of the process to oils and to some typical British coals and then to continue the work on a more theoretical basis.

The experiments described below are of a preliminary nature, and it is hoped to publish, at a later date, a more detailed account of the hydrogenation of various types of coal.

High Pressure Apparatus.—The apparatus employed for treatment of the oil was manufactured by the Lennox Foundry Company of New Cross, London. It consists essentially of a nickel-steel autoclave (see Fig. I.) of approximately 4 litres capacity, the walls being 3 inches in thickness, and capable, therefore, of resisting extremely high pressures. The vessel is enclosed in an asbestos-lined casing, is heated by means of gas flames and is rotated during the course of an experiment at a speed of 60 revolutions per minute. Pressures are indicated by means of a pressure gauge attached to one arm of the autoclave, and a thermometer inserted in a thermometer pocket penetrating to the centre of the vessel enables readings of temperature to be taken when required. Joints in all cases are cone shaped, metal-to-metal facings.

The Gas Oil.—The first experiments dealt with a gas oil supplied by the Anglo-Persian Oil Company from the refinery at Llandarcy. Such a distillate is of the type freely used in the cracking industry, but details of the results of pyrolysis of this particular oil have not yet been divulged.

The oil was found to possess the following characteristics:—

Specific gravity at 15·5°C	0·8500
Loss to sulphuric acid	10%
Iodine value	69·2
Distillation (Engler) initial boiling point	230°C
Fraction to 250°C	4%
„ „ 275°C.	33%
„ „ 300° C.	62%

Specific gravity was determined by means of a pyknometer, loss to sulphuric acid by agitation for 15 minutes on a mechanical shaker with an equal volume of 98 per cent. sulphuric acid, iodine value by Wij's method and details of distillation of 100 c.c. from an Engler flask at the rate of two drops per second.

These methods were adopted throughout the work. With regard to iodine absorption numbers, care was taken to employ iodine solution of the same concentration and to allow absorption to take

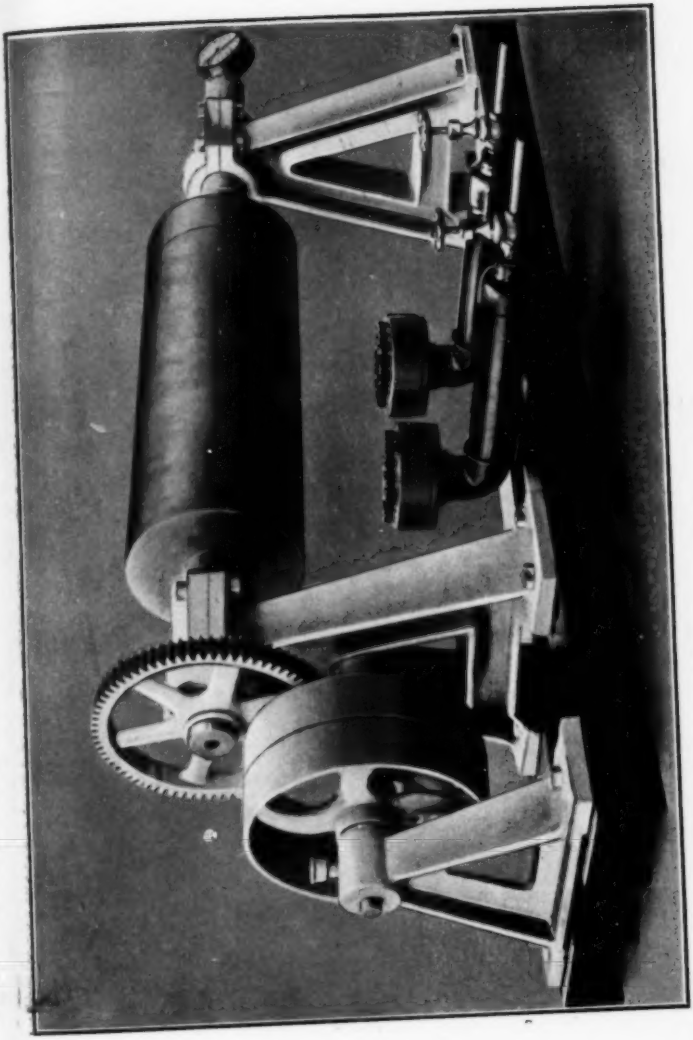
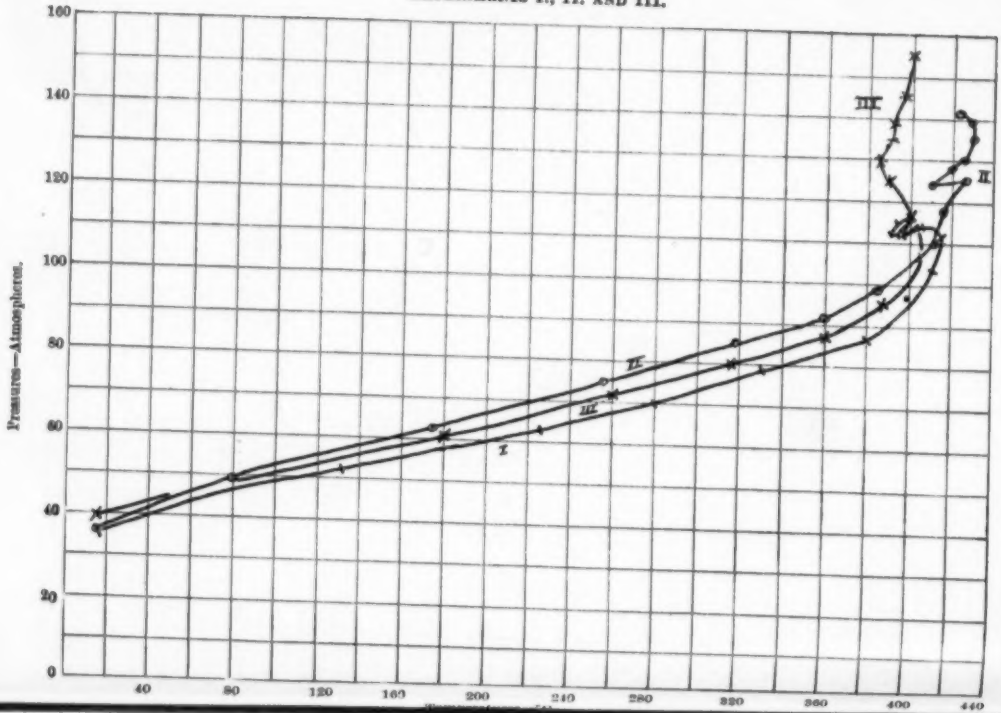


FIG. 1.

FIG. 2.

EXPERIMENTS I., II. AND III.



place during a period of two hours. Under these conditions the iodine absorption numbers give a good indication of the relative degrees of unsaturation of the oil and the several products.

Experimental.—In all the experiments to be described, 500 c.c. of gas oil was employed. Hydrogen was admitted to the autoclave from a cylinder to the initial pressure desired and readings of temperature and pressure were taken at intervals of 30 minutes.

Experiments I. and II.—The details of temperature and pressure treatment in the first two experiments are shown in Table I. and are indicated graphically in Figure 2.

TABLE I.

Hydrogenation of 500 c.c. of Gas Oil.

Times	Experiment I. Temp. (° C.)	Experiment I. Pressures (Atm.)	Experiment II. Temp. (° C.)	Experiment II. Press. (Atm.)
0	15	35	15	36
1	130	52	80	49
2	225	63	175	63
3	280	70	255	75
4	300	79	318	86
5	380	87	360	92
6	410	103	385	99
7	415	112	412	110
8	408	114	416	118
9	405	114	426	126
10	402	114	410	124
11	400	113	420	128
12	395	112	426	130
13	400	115	430	136
14	394	112	430	140
15	390	112	422	142
16	390	112	..	..
17	395	114	..	..
18	400	116	..	..
Final	15	25	15	23
Period above 400° C.	6 hrs.	..	4 hrs.	..
Maximum Temp.	415° C.	..	430° C.	..

It will be observed that a considerable reduction in pressure occurred in each experiment, the decline being greater in Expt. II., in which a higher maximum temperature was employed, the period of treatment, however, being less. Reference to Graph I. shows that in both runs, the temperatures and pressures increased uniformly until a temperature of about 410° C. was attained when the pressure began to rise sharply. This change appears more marked in Expt. II. because Expt. I. appears to have just failed to reach the optimum temperature conditions.

Residual Gas.—The residual gas from II. was discarded but that from I. was collected, metered and analysed. Its volume was

found to be 92·3 litres at 15° C. and 750 mm. and analysis indicated its composition to be as follows :—

Unsaturated hydrocarbons	0·2 per cent.
Methane, etc.	73·6 per cent.
Hydrogen	26·2 per cent.
Total	100·0 per cent.

A balance of hydrogen used and recovered shows that 9·0 grams had been absorbed and 12·2 grams evolved as methane. Actually, therefore, treatment of the gas oil under conditions as described in Expt. I. resulted in dehydration to the extent of 0·75 per cent. on the weight of substance taken.

This observation was in disagreement with accepted ideas regarding the hydrogenation of oils and it was therefore thought desirable to perform a blank experiment, using nitrogen in place of hydrogen.

Gas Oil heated with Nitrogen.

Experiment III.—A 500 c.c. batch of gas oil was used, the half-hourly readings of temperature and pressure being shown in detail in Table II. and graphically in Figure 2.

Table II.
Experiment III.

Time.	Temperature ° C.	Pressure (Atm.).
0	15	40
1	180	61
2	260	72
3	316	80
4	360	87
5	386	96
5	400	116
7	390	125
8	386	130
9	390	134
10	390	139
11	395	146
12	400	155
Final	15	50
Period at about 400° C.	3 hours	—
Maximum Temp.	400° C.	—
Increase in pressure	—	10

Reference to Figure 2. shows that the behaviour of the oil when heated in presence of nitrogen is fundamentally different than when hydrogen is employed. The differences may be summarised as follows :—

(a) An increment of 10 atmospheres pressure was registered in Experiment III,, whereas in the first experiments reductions in pressure had occurred.

(b) The temperature at which decomposition of the oil began to take place; *i.e.*, when a sharp rise in the temperature-

pressure curve became apparent, was lower with nitrogen than with hydrogen.

(c) The maximum pressure attained in the last experiment was considerably higher than in Experiments I. and II. although the temperatures and periods of heating employed were markedly less. In fact, the temperature was purposely prevented from increasing above 400° C. because of the dangerously high pressures produced and because the experiment was performed in the open laboratory without any means of protection in case of accident.

Residual Gas.—The residual gas occupying a volume of 180 litres at N.T.P. was found to consist of :—

Hydrogen	12·8 per cent.
Unsaturated hydrocarbons	2·6 per cent.
Methane, etc.	33·8 per cent.
Nitrogen	50·8 per cent.
Total	100·0 per cent.

Consequently, treatment of the oil under the conditions described had caused the evolution of 60·84 litres of methane and 23·04 litres of hydrogen, giving a total evolution of hydrogen of 13·01 grams. This figure is in fairly close agreement with that of 12·24 grams obtained in Experiment I.

The experiments indicate, therefore, that when the particular gas oil under consideration is subjected to high temperature and pressure treatment in presence of nitrogen, substantial dehydrogenation of the oil takes place, methane and free hydrogen being evolved. When, however, hydrogen is employed in the place of nitrogen, hydrogenation and dehydrogenation occur simultaneously : and in both cases, substantially the same quantity of hydrogen is given off, either in the free or combined state.

Experiment IV.—At this stage, it was decided to study the effect of hydrogen concentration upon the final result. The composition of the residual gas in the first experiment had shown that as the reaction proceeds, hydrogen is absorbed and that the partial pressure of hydrogen is therefore continuously decreasing. Consequently, in a closed apparatus, where facilities for renewing the hydrogen atmosphere are not available, hydrogenation will tend to cease. In fact, it is probable that complete reduction will only take place when a constant circulation of hydrogen at a definite pressure is maintained through the plant.

With these considerations in mind, a fourth experiment was conducted in which 500 c.c. of gas oil were heated in presence of hydrogen to 410° C. for one hour. After cooling, the residual gas was withdrawn, a fresh batch of hydrogen admitted and treatment continued for four hours at temperatures above 400° C.

TABLE III.

Experiment IV.—Gas oil heated with hydrogen.

Times (0·5 Hours)	1st Day. Temp. (° C.)	1st Day. Press. (Atm.)	2nd. Day Temp. (° C.)	2nd. Day Press. (Atm.)
0	15	30	25	36
1	130	51	75	47
2	215	62	165	63
3	280	68	230	76
4	330	77	300	90
5	365	83	345	101
6	395	93	385	110
7	410	107	410	118
8	410	108	415	123
9	—	—	420	126
10	—	—	420	127
11	—	—	415	124
12	—	—	403	122
13	—	—	420	130
14	—	—	420	130
Final	25	25	15	22
Maximum Temp.	410	—	420	—
Press decrease	—	5	—	14
Period above 400° C.	1 hour	—	4 hours	—

Analyses of Residual Gases.

	1st Day.	2nd Day.
Volume of residual gas	86·0 litres	76·0 litres
Composition.		
Hydrogen	76·5 per cent.	18·4 per cent.
Methane, etc.	21·9 „ „	81·5 „ „
Unsaturated hydrocarbons	1·6 „ „	0·0 „ „
Totals	100·0 „ „	99·9 „ „

It will be observed from the above that the fall in pressure, *i.e.*, hydrogen absorption, was considerably greater on the second day and that the analyses of residual gases supply further evidence that hydrogenation had occurred to a greater extent during the second period of treatment. It is probable, however, that the temperature attained on the first day was too low to effect any considerable hydrogenation of the oil.

Considering the reductions in pressure and the volumes and compositions of the evolved gases, it was found that 14·7 grams of hydrogen had been absorbed by the oil and that 14·4 grams had been evolved as methane. Consequently, the employment of a larger proportion of hydrogen had effected a greater degree of hydrogenation than in the previous hydrogenation experiments.

It is clear, therefore, that hydrogen concentration is an important factor since the temperatures, pressures and times of heating were approximately similar to those employed in Experiments I. and II.

It will be a matter for subsequent investigation to determine the maximum percentage of hydrogen which the particular sample of oil will take up under the conditions of temperature and pressure already used and to study in this connexion the influence of pressure. It is conceivable that, within limits, hydrogen supply is more important than the employment of excessively high pressures and that hydrogenation is a normal reaction in which temperature, concentration and time are the determining factors.

The Products.—The crude products from the four experiments were dark-red, mobile liquids possessing the faint but characteristic odour of cracked spirit. In no case was there any visible deposit of carbon, but it was noticed that Product III. (nitrogen) was the darkest in colour and was quite opaque, whereas the other crudes were transparent. The main properties of the several products are summarised in Table IV. in which the original gas oil is also included.

TABLE IV.

Properties of the crude products.

Property.	Gas oil.	Prod. I. Hydrogen	Prod. II. Hydrogen	Prod. IV. Hydrogen	Prod. III. Nitrogen
Specific gravity ..	0·8500	0·8385	0·8370	0·8360	0·8250
Loss to sulphuric acid	10%	40%	40%	40%	38%
Iodine value (Wij's) ..	69·2	416	509	432	618
Distillation (Engler)					
Initial B.P.	230° C.	42° C.	36° C.	35° C.	44° C.
Fraction to 100° C. ..	—	17·0%	22%	22·5%	10·0%
„ „ 125 ..	—	26·0	31·5	33·0	19·0
„ „ 150 ..	—	35·0	39·5	41·5	28·0
„ „ 175 ..	—	44·0	47·0	48·5	38·0
„ „ 200 ..	—	51·0	53·0	53·5	—
„ „ 225 ..	—	63·0	58·0	59·0	—
„ „ 250 ..	4	—	65·0	65·0	—
„ „ 275 ..	33	—	69·0	69·0	—
„ „ 300 ..	62	—	74·0	74·0	—

The following points emerge from a perusal of the above figures :—

(a) The specific gravities of the products and especially of Product III. are lower than that of the original gas oil. With respect to the hydrogenated substances, specific gravity appears to decrease as the treatment of the oil becomes more drastic: and with this observation occurs an increase in the percentage of petrol (up to 175° C.) contained in the products.

(b) The degree of unsaturation as indicated by loss on agitation with concentrated sulphuric acid is practically the same in all cases. This test, however, is empirical since aromatic hydrocarbons may also be dissolved from the oil.

(c) The iodine absorption numbers indicate that Product IV. is the least unsaturated as would be expected from a con-

sideration of the proportion of hydrogen absorbed during its production.

(d) The iodine values studied in conjunction with the appropriate conditions of hydrogenation and with the percentage contents of petrol appear to indicate that Product II. has suffered a greater degree of pyrolitic decomposition than Product I, and that Product III. has been still further cracked but simultaneously hydrogenated.

(e) A comparison of the specific gravity and iodine value of Product III. with those of the hydrogenated oils suggests that the latter are rich in aromatic hydrocarbons.

The petrol fraction from each product was refined by agitation on a mechanical shaker for one hour with 4 per cent. of sulphuric acid, followed by alkali and water washes and a final distillation. The refining losses were of the order of 8 per cent., and the refined products were water-white in colour. The hydrogenated petrols were unusually sweet in odour and have retained their colour almost completely after standing for 16 months in the laboratory, whereas that from Product III. possessed a slight cracked odour and its colour has deteriorated somewhat markedly. Nevertheless, it appears to be far superior to many samples of cracked spirit which are now on the market. The properties of the refined spirits are indicated in Table V., and are contrasted with those of some commercial brands of petrol purchased in the open market.

TABLE V.

Properties of the refined spirits.

Petrol.	Specific gravity.	Iodine value.
From Product I	0·7392 ..	185·4
„ „ II.	0·7517 ..	181·0
„ „ IV.	0·7460 ..	143·0
„ „ III.	0·7746 ..	350·6
A.	0·7410 ..	24·5
B.	0·8454 ..	224·8
C.	0·7297 ..	24·8
D.	0·7627 ..	24·3
E.	0·7627 ..	77·6

The refined hydrogenated spirits, therefore, compare favourably in specific gravity with the commercial brands included and not unfavourably as regards iodine values with at least one of the commercial petrols. Petrol IV. is undoubtedly the best and Petrol III. the least valuable of the four synthetic, refined spirits. The kerosene and residual fractions were not further dealt with.

CONCLUSIONS.

(1) The hydrogenation of a gas oil under high pressures and at temperatures of between 400° and 420° C. leads to the production of substantial yields of gaseous and of low-boiling hydrocarbons.

(2) The mechanism of the reactions involves initial decomposition or cracking followed by hydrogenation of the unsaturated hydrocarbons produced in which the concentration of hydrogen is a determining factor.

(3) The products are unsaturated but are less so than those obtained by cracking under comparable conditions.

(4) Continuous substitution of the residual atmosphere by hydrogen will probably effect the production of saturated bodies and it may be anticipated, therefore, that the continuous process adopted by Bergius will give more valuable substances than would an intermittent method of treatment.

Thanks are due to Dr. J. S. Haldane, LL.D., F.R.S. and Mr. J. Ivon Graham, M.A., M.Sc., A.I.C., of the Mining Research Laboratory, University of Birmingham, for their advice in the course of this research and to Messrs. F. Lawrence and F. H. Price, who have assisted in the analytical work.

Note on the So-called Hydrogenation of Gas Oil.

By O. E. Mott, Ph.D., and A. E. Dunstan, D.Sc., F.I.C., F.C.S.

This work was carried out in order to compare the results obtained by the Bergius method with those obtained by cracking at the same temperatures and pressures.

As it would be difficult otherwise to arrange comparable conditions, the cracking experiments were conducted under the pressure of an inert gas (nitrogen). Steam was also tried.

The apparatus consisted of an oxygen cylinder (capacity 9 litres) mounted on swing links above a row of gas jets, and connected flexibly to pressure gauge and relief valve by means of solid-drawn steel tube. The cylinder was inclined somewhat so as to keep the neck joint covered with oil with the object of minimising or preventing gas leaks. It was given a reciprocating motion from a motor. A pyrometer was mounted in its axis.

The cylinder was charged with the oil, connected up and evacuated. The gas charge was then introduced from a cylinder. After the specified time of heating, the cylinder was allowed to cool over-night. The charge was then blown off and measured, and a sample of the gas, which was not measured, taken for analysis.

The gas oil used through had the following characteristics:—

Engler Test.	I.B.P. ..	.. 134°	Sp. gr. .. 0·849
		Per cent.	
200°	.. ..	.. 1	Analysis.
225	.. ..	.. 4	H = 13·25
250	.. ..	.. 22	C = 86·15
275	.. ..	.. 50	S = 0·87
300	.. ..	.. 76	
			100·27

The temperature was in each case maintained at 405 to 420° C. for 2¾ hours (3¼ hours for steam), but in experiments 2 and 3 the temperature was accidentally allowed to reach 450° for a few minutes.

The charge was in each case 1500 c.c. of oil and gas sufficient to bring the pressure in the cold to 22 atmospheres. When steam was used, 133 c.c. of water were charged with the oil.

Summary of Results.

Experiment No.	1.	2.	3.	4.	5.
Gas	N_2	H_2	H_2	N_2	H_2O
Pressure:					
Initial (cold)	22	22	22	22	—
Maximum	135	114	112	132	105
Final (cold)	32½	24	24	34	3
Liquid yield (c.c.) ..	1080	1225	1300	1200	1300
Analysis: H (per cent.)	12·5	12·5	12·4	12·3	12·4
C „ ..	86·5	86·6	86·3	87·5	87·3
S „ ..	0·78	0·76	—	0·82	0·86
Sp. gr. at 60° F. ..	0·821	0·823	0·818	0·828	0·826
Loss to H_2SO (per cent.)	33	29	—	—	—
Engler to:					
200° (per cent.) ..	52	52	50·5	49·5	51
Sp. gr. of spirit ..	0·749	0·745	0·746	0·747	0·745
H_2SO_4	16·5	14	—	—	—
Residue sp. gr. ..	0·935	0·930	0·920	0·928	0·927
Engler to 175° (per cent.)	—	—	37·6	38·4	38·8
Spirit: Sp. gr. ..	—	—	0·724	0·727	0·726
H_2SO_4 ..	—	—	14	14	16
Residue: Sp. gr. ..	—	—	0·903	0·909	0·910
Viscosity ..	—	—	40	40	40
Gas:					
Vapour density ..	13·7	6·2	5·9	15·2	17·9
Analysis					
CO_2H_2S (per cent.). .	0·5	—	—	—	0·4
O_2 „ ..	2·5	—	—	—	—
Unsat. „ ..	0·5	1·0	1	1·2	6·0
H „ ..	—	54·3	49·8	—	—
N „ ..	70·5	—	—	68·4	—
Paraffins „ ..	26·6	45·7	49·9	33·2	93·6

As regards the liquid product, the product obtained when hydrogen was used is superior in colour and clearness, and in absence of gumming constituents, to that obtained with nitrogen. This is the only evidence of hydrogenation. The other evidence,

such as lowering of specific gravity and loss to sulphuric acid, is conflicting. The ultimate analyses show that there is no hydrogenation, and that the use of hydrogen does not even check dehydrogenation. This is shown by the lower maximum pressures obtained with hydrogen as compared with nitrogen.

Free hydrogen is taken up, however; the gas analysis shows that approximately half the gas consists of hydrocarbons, in the case of hydrogen experiments. The partial pressure of hydrogen is, therefore, 12 atmospheres; consequently about half the hydrogen has been used up or about 6 grammes (0·5 per cent. on the oil charged) out of the total of 13·5 grammes of hydrogen charged.

On the evidence it is clear that any hydrogen fixed must have gone into the gaseous portion.

Whether the presence of hydrogen promotes the formation of aromatic compounds, or not, there is no evidence to show.

Conclusions.

The work done is insufficient for a final verdict, but it appears that under the conditions used hydrogen has little or no effect in hydrogenating or preventing dehydrogenation, so far as the liquid products are concerned, under the experimental conditions detailed here. In this respect hydrogen and nitrogen give much the same result.

Estimation of Sulphur in Volatile Hydrocarbons, with particular reference to Benzol, by an Improved Lamp Method.

By E. Lawson Lomax, M.Sc., A.I.C., F.C.S., and A. M. E. Bevan.

It is well known that the determination of sulphur in volatile hydrocarbons, particularly benzol, by the lamp method is not altogether satisfactory owing to the fact that certain sulphur compounds are not easily combustible, and are liable to pass away incompletely oxidised. This is particularly the case with benzol, in which both carbon bisulphide and thiophene may be present.

The method which we have developed ensures complete combustion of either carbon bisulphide or thiophene, the sulphur content being converted either to sulphur dioxide or to the trioxide.

The method employed by us for carrying out the determination is shown in the accompanying sketch (p. 916), but the absorption apparatus is, of course, subject to wide variation and modification.

The Dreschel wash bottles, W, containing glass beads in the bottom of each, are each partly filled with 250 c.c. of a 5 per cent. pure sodium carbonate solution, and 1 c.c. of pure bromine is added to the solution in each bottle to ensure the oxidation of any trace of sulphur dioxide in the products of combustion. The bubbler, V, is fitted to the second Dreschel wash bottle to catch and retain any solution mechanically carried over from the bottles, W, by the passage of the current of air. The U-tube, Z, is partly filled with mercury and fitted to a T-piece of which the horizontal tube connects the wash bottles and bubbler to the vacuum pump. This U-tube acts as a vacuum gauge. To the outlet tube of the first wash bottle is connected the curved glass chimney, G, with a drawn out reducing tube intermediate to give flexibility. The glass chimney is clamped in a stand so that it can be raised or lowered at will for adjustment purposes. In the mouth of the chimney is fitted horizontally a circular porcelain disc, B, and held in position by a rubber packing ring, C, of rectangular cross section. The porcelain disc has a circular hole in the centre of diameter equal to half the diameter of the disc and is fitted with the double terminals, T.

In the two upper terminals are clamped two short pieces of stout copper wire of rectangular section, each flattened at one end. A pin hole is drilled in the centre of each of the flattened ends and the two ends of the platinum wire helix, E, are each

threaded through the pin holes and then twisted round the copper wires.

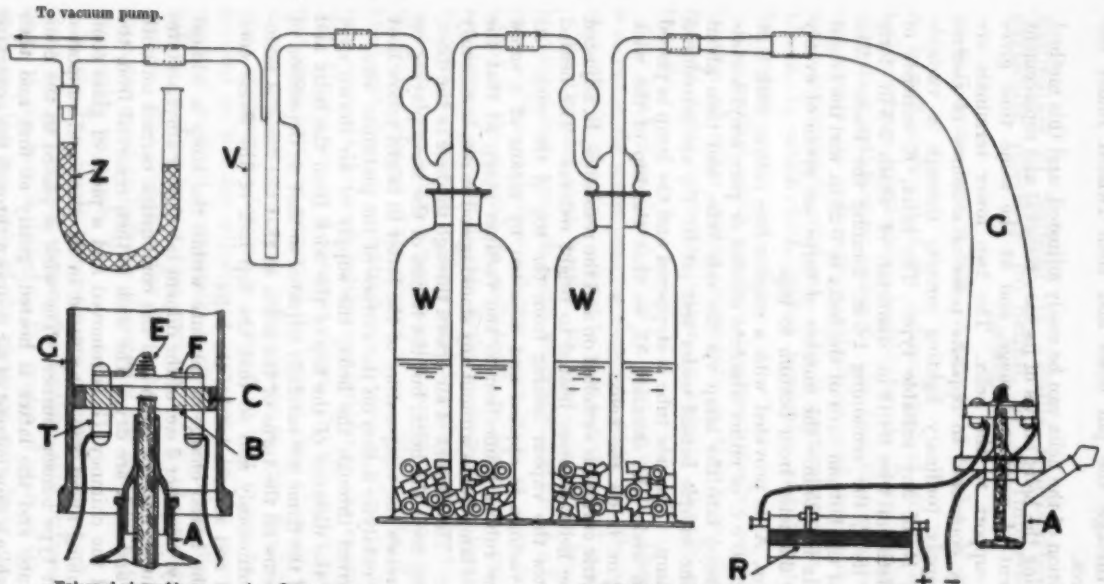
The position of the helix can be easily adjusted, and this method of supporting the helix allows of its easy removal and replacement in the event of wear or damage, and at the same time gives adequate support to the helix. The two lower terminals are respectively connected to opposite poles of a source of electric current supply (ordinary lighting circuit) through a variable resistance, R, of any suitable type. The helix, E, consists of 5 in. of platinum wire 0·012 in. diameter, of which 3·5 in. form the helix itself, the remaining 1·5 in. forming the leads. The diameter of the bottom turn of the helix is 0·25 in. and the height of the helix is 0·25 in.—the number of turns are seven of evenly decreasing diameter from bottom to top.

The lamp, A, is provided with a sulphur-free cotton wick 5 in. in length; 10 c.c. of either absolute alcohol or pure amyl acetate are introduced into the lamp via the side tube, and then about 2 c.c. of the sample benzol under test (at 60° F.) are introduced into the lamp. The side tube is stoppered and the lamp is placed in position under the chimney, G, so that the top of the wick is about $\frac{1}{2}$ in. below the helix.

The electric current is switched on and the resistance, R, adjusted so that the helix becomes heated to bright redness. The heated helix ignites the vapour issuing from the top of the wick. At once the vacuum is applied and adjusted by means of a screw clip on the rubber connection to the vacuum pump so that the flame of the lamp burns without any smoking and as non-luminously as possible. The current of air drawn through the hole in the discs, B, of course cools the helix, but the flames of the lamp playing on the helix raises the temperature of the latter to bright yellow heat indicating catalytic action on the surface of the platinum wire.

The current through the helix, the supply of air drawn over the helix, the distance of the top of the wick from the helix and the size of the flame are carefully adjusted so that no deposition of carbon occurs on the turns of the helix, so that the flame is maintained continuously and so that the top half of the flame cone is covered and surrounded by the helix.

When the initial charge of mixture within the lamp is almost burnt away, a further 5 c.c. of the diluent (alcohol or amyl acetate) are introduced into the lamp and the combustion carried on until the lamp and wick are dry. The wick is then removed from the lamp, and the chimney, G, is removed and a piece of glass combustion tubing about 8 in. long fitted in its place and supported over a slit type bunsen burner. The wick is placed in the combustion tube and the latter is heated, gently at first and then strongly while a slow current of air is drawn through the apparatus



Enlarged view of lamp, and coil holder.

A. Lamp.
B. Porcelain disc.
C. Rubber packing ring.
E. Platinum helix.
F. Copper wire leads to helix.
G. Curved glass chimney.
R. Variable resistance.
T. Terminals.
V. Small wash bottle.
W. Dreschel wash-bottle containing beads.
Z. Mercury vacuum gauge.

APPARATUS FOR ESTIMATION OF SULPHUR IN BENZOL.

until the wick is completely ashed. The precipitation and estimation of the sulphur as barium sulphate present in the sodium carbonate solution at the end of the test is carried out in the usual manner.

To obtain concordant results in our laboratory it was found essential to fit the second set of wash bottles, bubbler and vacuum gauge, identical with and alongside the set on which the test was being run and connected to the vacuum supply, and we advocate this in all cases. The wash bottles of the "blank" set were partly filled with the same volume and strength of sodium carbonate solution (from the same bulk solution) and with pure bromine as used in the "test" set. The current of air through the "blank" set was adjusted so that the mercury levels in its vacuum gauge were the same as those in the "test" set. Thus any trace of sulphurous impurity in the reagents used or in the atmosphere of the laboratory can be estimated as barium sulphate and the "blank" weight of barium sulphate subtracted from the weight of barium sulphate obtained from the "test" solution.

All joints in the apparatus are glass to glass with rubber tubing connections.

The table below gives a comparison of the results obtained from estimations by the improved lamp method with and without "blank" determinations, and by the standard lamp method with and without "blank" determinations.

Synthetic mixture tested.	Sulphur found, using improved method without "blank." Per cent.	Sulphur found, using improved method with "blank." Per cent.	Sulphur found, using standard method without "blank." Per cent.	Sulphur found, using standard method with "blank." Per cent.
C_6H_6 147·4040 gms.	0·56	0·52		
C_4H_4S 0·5353 gms.	0·54	0·50	0·43	0·42
CS_2 0·6408 gms.	0·61	0·49		
Approx. sulphur content = 0·50 per cent. Sp. gr. at 60° F. = 0·8831				
C_6H_6 80·4895 gms.	0·54	0·50	0·46	0·46
C_4H_4S 1·0705 gms.	0·63	0·50		
Approx. sulphur content = 0·50 per cent. Sp. gr. at 60° F. = 0·8831				

Many determinations have been carried out on benzines and kerosenes giving similar results to the above, but as these were natural products in which the sulphur content might be open to question, we have preferred quoting results obtained on definite mixtures of pure bodies of which the sulphur content is actually known

Our thanks for permission to publish these results are due to the Directors of Messrs. Vickers, Ltd., in whose research laboratory this investigation was carried out.

Bauxite as a Refining Agent for Products Distilled from Petroleum.*

By A. Guiselin.

I have recently been able to examine very completely all the particulars of a remarkable English study, of which I am happy to give a minute and impartial analysis, namely, an article published in the *Journal of the Society of Chemical Industry* on June 13th, 1924, by A. E. Dunstan, F. B. Thole and F. G. P. Remfry upon :—

"Bauxite considered as a refining agent for crude petroleums and their by products."

First Theories regarding the Decolorization of Mineral Oils by Means of Clays.

Having been led many years ago to use industrially the affinity of certain bodies for colouring matter in mineral oils, it was only about 1912 that I tried to penetrate the mystery of this peculiar property which until that time had received very little explanation.

In a communication which appeared in 1913 in the *Journal des Matières Grasses*, I was able then to show that this decolorizing property had been falsely attributed to the properties possessed by bodies to effect a true separation of hydrocarbon mixtures submitted to their action, by allowing hydrocarbons less and less dense (*i.e.*, less and less volatile) to filter upwards or downwards.

This physical separation was explained according to these authors (Dr. David T. Day) by the sole fact that the viscosity of the hydrocarbons and, consequently, their capillarity (or their surface tension) varied regularly either with their boiling points or their specific gravities.

Now, it is well known that the sp. gr. of a hydrocarbon abstracted from petroleum is not sufficient to determine it chemically ; since petroleums are complex mixtures of a number of hydrocarbons distilling between wide limits of temperature, and belonging to all the chemical series depending on the number of their carbon and hydrogen fractions.

I therefore thought that, in a mixture of hydrocarbons belonging to different chemical groups, separations could be effected by reason of their affinities for decolorization materials rather than by means of their varying volatility.

By taking crude mineral oils containing numerous individual fractions of these chemical groups, and by submitting them to methodical filtrations through prepared clays, I was then able to confirm that this increase in sp. gr. of the filtrates was not

* Translated from the French.

due solely to the increase in molecular weight of these hydrocarbons and their boiling point, but rather to the increasing richness in carbon in the molecule. The most hydrogenated bodies, *i.e.*, the most saturated, have for an equal volatility a lower attraction for argillous earth than the less saturated.

This explanation supplies the reason for the particular attraction of these decolorising bodies for polymerised or highly condensed hydrocarbons which usually constitute the colouring material in crude petroleum, either distilled or oxydised.

Starting from an oil of known fractionation, I was able to separate oils increasing in colour and density, but which distilled very closely within the same limits of temperature. Moreover I have proved that earths, impregnated and saturated with colouring matter from oils which cannot be extracted by light paraffin hydrocarbons, would give up this colouring matter to aromatic hydrocarbons preferably previously decolourised in order to increase the sensibility of reaction.

Later the hypothesis was brought forward by other workers that clays, bauxites, decolorising silicas or porous oxides were endowed with electric properties which bring about separation of hydrocarbons by means connected with the physical constants of the latter.

This new theory, by destroying the elementary theory of separation by order of density, in reality comes forward in support of mine, in the sense that it was very possible to admit a simple law uniting electric conductibility of oils with their chemical composition. (We shall see further on that our hypothesis has been proved, exactly, by the English authors of the work which we are going to analyse). Let us now examine in detail, after these preliminaries, the recent observations of the English authors.

Initial Researches on the Phenomena of Decolorization by Porous Bodies.

According to these authors the selective properties of wood, charcoal, porous earths, silicas, of alumina, etc., for coloured and odorous materials in oils, have been known for a very long time.

This is very true, and let us add that for a very long time vaseline has been prepared in France, by filtration through prepared beds of dried clay, from the distillation residues of crude petroleum oils. More recently the method has been modified by using as raw material, residues filtered in America through animal black and exported under the name of "Filtered" for use also as cylinder lubricating oils where superheated steam is employed.

But if this industry is an old one, it has remained for a long time without making any progress. It is only in the course of

recent years that buyers thought of utilising substances other than natural silicates of alumina, and that they perceived that the number of the latter could be considerably increased.

Thus they found that artificial and dehydrated inorganic gels like those of silica, alumina and iron, were endowed with these properties, as well as certain natural products like bauxite suitably dehydrated. But they discovered at the same time that the decolorizing power of these bodies was in no way connected with their chemical composition. On the other hand, results showed that the physical structure of these substances were of considerable importance to the results of decolorization.

It was thus that bauxite, which is extremely porous, and capable of being made into small granular form, was pointed out at once as being a material particularly suited to serve this industry in the treatment of mineral oils.

Action of Dehydrated Bauxite upon Organic Compounds of Sulphur.

In the meantime it was noticed that Bauxite had likewise a great affinity for odorous and coloured compounds of sulphur, contained in burning oils produced from certain sulphurous deposits.

According to the above English authors it was as the result of researches made in England that the Burmah Oil Co. has employed this material for some years in the decolorization and desulphurisation of these lamp oils. For this operation it utilizes cylindrical filters 8 feet high and 3 feet in diameter. After saturation the bauxite is washed with spirit, the spirit steamed out, and the bauxite roasted in furnaces similar to those for calcining pyrites. In this regenerated state, it may be utilized in new operations.

The Anglo-Persian Co. has found that these filtrations through bauxite not only decolorized lamp oils, but also desulphurized them when the bauxite was utilised immediately on issuing from the drying ovens when its temperature was still 200°. Under these conditions the sulphurous oils gave up the greater part of their sulphur. Oils containing 0·134 per cent. of sulphur were brought down to a sulphur content ranging around 0·02.

Action of the Atmosphere on Dehydrated Bauxite.

One must admit that this desulphurising action is especially appreciable in the case of bauxites previously brought to a temperature of 200° since, all things being equal, the same bauxite cooled and utilised under the same conditions at ordinary temperature no longer furnishes oils with a lower sulphur content than 0·110 per cent.

I had myself noted this peculiarity for a long time in the treatment of burning oils by Vanves clay, previously dried in ovens at temperatures of from 350° to 400°, and added while still hot to oils with violent agitation, and I recently made allusion to this precaution in my last lecture to the Society of Chemical Industry, "Upon refining at the places of consumption." But I must say that so far I had confirmed the fact without determining the reason, only imagining that it must arise from the particularly anhydrous state of this argillous earth and from the disappearance of the gasses enclosed in the pores.

This is the explanation which the Anglo-Persian Oil Co. itself now gives of this increased power of the bauxite, confirming also that there is produced in the mass of oil to which hot bauxite has been added an increase of temperature greater than that which should result from the addition of the calories of this latter. Here we have a new interesting fact to take note of which would tend to prove that the bauxite not only acts as a filter by adsorption, but that it can produce real mechanical actions in the oils. In the meantime we must wait for it to be proved that it favours chemical reactions. The Anglo-Persian conclude that bauxite can be employed as a general refining agent for all petroleum oils.

In our opinion one is forced to this conclusion, especially as it has been found possible to utilise simple regenerating processes which render this reagent inexpensive, and theoretically indistructible, and particularly since the increase in price of reagents ordinarily in use for refining such as sulphuric acid and soda.

We reproduce below the results of a series of tests made upon different products with roasted bauxites, utilised hot as they came out of the oven, or cooled in air before use.

		Sulphur Content after Treatment with			
Products.	Lb. of bauxite per gall. of products treated.	Untreated bauxite.	Bauxite roasted and hot.	Bauxite roasted and cold.	Content in sulphur of the initial product.
Kerosene	–	—	—	—	0·134
	9	—	0·017	—	—
	4	—	0·017	—	—
	9	0·110	—	—	—
	5	—	0·018	—	—
	2	—	—	0·098	—
Kerosene	–	—	—	—	0·150
	3	—	0·030	—	—
	2	—	0·060	—	—
White Spirit.. ..	–	—	—	—	0·150
	2	—	0·022 (1)	—	—
Petrol	–	—	—	—	0·078
	2	—	0·014 (2)	—	—

(1) The white spirit extracted by steam from the bauxite contained 0·18 of sulphur ; and (2) the petrol 0·440.

Hypothesis and Laws Relating to Decolorization and Desulphurisation of Mineral Oils by Bauxite Verification of the Law of Freundlich.

We shall now pass on to the examination of the other factors capable of having an influence upon the decolorising power of Bauxite.

The English authors have studied, in this connection, the influence of the size of the bauxite grains employed in the filter. They have proved that the power increased with the fineness of the grains, but that the duration of the filtration increased in the same manner. They then determined the size of the grains adapted to procure filtration within a suitable time. According as it is desired to operate on a large scale or in the laboratory the grains should be capable of passing through sieves with a mesh 30/60 per square inch or 20/90 mesh.

The English authors explain, at this point, that if the opinion of refiners is not yet definitely favourable to the use of bauxite as a refinery agent, it is because of ignorance as to the real causes for the great variability of the results obtained by works which use any sort of bauxite, especially in the case of treatments by filtration. It is, indeed, our opinion as experts that there still remains much to be done in the way of utilising bauxites, gelatinous silicas, oxides and silicates.

Besides, over and above the process of filtration, one may still have recourse to processes employing agitation, or distillation through layers of bauxite. However it seems that filtration is best suited in the utilisation of the absorbent power of bauxite to which one must attribute its peculiar affinity upon coloured and sulphur compounds.

The English authors, starting from the fact that roasted bauxite is an excessively porous body, consequently possessing for a given weight a considerable surface of contact, calculated that, thanks to the latter, it was possible for this surface energy to transform itself into calorific energy.

This transformation taking place at the moment of adsorption obeys the law of Freundlich, expressed by the formula :—

$$\left(\frac{x}{M}\right)^{n} = h\,c$$

in which x is the total quantity of sulphur or colour absorbed by the bauxite

m is the weight of this bauxite to 100 parts of kerosene

n a constant

c the percentage of sulphur or of colour of the original oil.

To verify this latter hypothesis they then carried out a series of tests with bauxite roasted at 600/550° C., cooled in a desiccator and agitated in given proportions with kerosenes having variable sulphur and colour content.

The Law of Freundlich and the Decolorisation of Mineral Oils by Bauxite.

Starting with samples of kerosene of given colour, estimated in percentage of the deepest colour, agitated 10 minutes with 5 parts by weight of bauxite per 100 volumes of oil (exactly 3·5 gr. per 70 c.c.) they obtained the result given below which effectively show that $\frac{X}{M}$ is approximately proportional to the initial concentration of the colour =100 with an exponential n equal to 1. The law of Freundlich would, therefore, be verified in this case as regards the colour.

Decolorisation Test by Bauxite.

Colour of the samples in per cent. Before treatment.	After.	Colour absorbed.	Colour absorbed, per cent.	Value of X/M.	Value of K.
100·0 ..	52·0 ..	58·0 ..	48 ..	9·6	0·96
58·0 ..	32·0 ..	26·0 ..	45 ..	5·2	0·9
42·0 ..	21·0 ..	21·0 ..	50 ..	4·2	0·10
14·2 ..	5·5 ..	8·5 ..	61 ..	1·74	0·125
4·6 ..	2·2 ..	2·4 ..	52 ..	0·45	0·098
3·5 ..	1·7 ..	1·8 ..	52 ..	0·54	0·097
1·7 ..	0·8 ..	0·9 ..	53 ..	0·17	0·100

Actually, we have added to the original table the calculated values of K, which are not entirely constant.

These results, indeed, show that the quantity of colour absorbed per gramme of bauxite is more and more feeble in proportion as one starts from less coloured products.

It is, indeed, a very usual occurrence in the manufacture of vaseline during filtration of black residue through clays.

In this process vaseline is passed through successive filters until the product runs off at the desired colour. Now, it is well known that much more earth is required to decolorise an orange residue to lemon colour than a black residue to orange.

Up to the present we explained this difficulty by supposing that decolorising earths had selective properties for the numerous products which form the total colouring material of petroleum oils and that these different colouring materials could exert, for a similar depth of colour a lesser or greater resistance to absorption.

In the last numbers of *Matières grasses* of 1924 we said that two oils of the same tint by the colorimeter, obtained either by colouring decolorised oil with a certain percentage of original oil, or by decolorising the original oil up to the said tint, would behave absolutely in a different manner *vis-a-vis* a decolorising earth, the materials likewise colouring the two oils being, in this case, totally different, and this difference being especially appreciable

as regards the "decolorisers." Besides, it must certainly be thus if we examine more closely the experimental results furnished by the English authors.

Let us suppose that these authors, in order to bring their crude oil of 100 colour to the tint 3·5 have done this either by adding the quantity of earth m at one time or by adding a quantity m^1 by successive fractions of 5 gr.

If we admit that the law which they have established is true for no matter what colour of petroleum, whether it results from natural products or is formed by distillation, or whether the colour originates from a partial decolorisation of the original oil, we shall apply the formula of Freundlich :—

1st Case—The colour C = 100
The coefficient K = 0·096, n = 1

$$\left(\frac{X}{m}\right)^n = K.C$$

If we wish to come back to the colour 3·5, one must take 96·5 from 100 ; that is, make x = 96·5 and we shall have :—

$$\frac{96{\cdot}5 = 0{\cdot}096 \times 100}{m}$$

whence m = 10 gr.

That is to say that with 10 gr. of bauxite, we shall decolorise our oil in a single operation to the colour 3·5.

2nd Case. The colour C = 100
The co-efficient K = 0·096
make m = 5 gr.
We shall have $X = 5 \times 0{\cdot}096 \times 100 = 48$.

The petroleum will be brought to the tint of 52 by this first addition.

Let us now treat by 5 new grammes of bauxite and we shall arrive, if the law is exact, at the tint 26 and in order to obtain the colour 3·5, we shall require not 10 gr. of bauxite, but five times 5 gr.—25 gr.

This theoretical result, taken from formula, is contrary to what we have up till the present found in France, with argillous earths of silicate of alumina, which probably act identically according to the same mechanism as bauxite. Thus, there is a special interpretation to be given to this English rule, which can only be applied as it is in the English paper—that is to say, to tinted products obtained by dilution of the original colouring material.

But this rule cannot be utilised for two products having different or equal tints, due to different origins. (The paper does not indicate how the decolorization is effected, by filtration or agitation. It does not indicate whether it is a question of distilled kerosene or of kerosene already refined by ordinary processes.) However, this law, applied correctly, leads to the practical conclusion that it is good to decolorize concentrated solutions, and not to dilute the oils.

The Law of Freundlich and the Desulphurisation of Mineral Oils by Bauxites.

Let us now pass to the results obtained by the English authors with mineral oils containing sulphur.

The same samples mentioned above diluted in the same way and consequently containing decreasing quantities of sulphur, were treated with quantities of bauxite equivalent to 2 lb. per gallon—viz., 70 c.c. with 14 gr. of bauxite.

The results obtained were as follows:—

Table III.

Sulphur per cent. initial.	Colour initial.	Sulphur per cent. final.	Per cent. sulphur removed.	Log. $\frac{X}{M}\times 100$.	Log. $\frac{X}{M}\times 100$.	Initial sulphur, gr.	Log of the initial sulphur, gr.
0·289	1·9	0·222	19·7	1·3463	0·222	0·158	1·1987
0·230	3·5	0·200	13·0	1·0682	0·117	0·126	1·1004
0·207	1·4	0·168	18·9	1·1818	0·152	0·113	1·0719
0·126	0·6	0·108	18·3	2·9642	0·090	0·069	2·8388
0·096	0·2	0·074	23·0	2·9345	0·052	0·052	2·7160
0·027	—	0·017	37·0	3·5911	0·015	0·015	2·1764

(It is difficult to follow the result of the table and the conclusions of the authors, into which errors must have slipped, seeing that the values $\frac{X}{M}$ of column 6 are not equal to those which can be obtained by dividing the difference between the figures of the columns 1 and 3 by 20 gr.

The authors give the following interpretations to these results. First of all the decolorisation curve is no longer a straight line; therefore, the formula of Freundlich takes the form:—

$$\left(\frac{X}{M}\right)^{1/3} = k.C$$

in which n is equal to one-third.

In any case, without lingering over the results indicated in Table III, let us note that the English authors deduce that the above anomalies are due to the simultaneous influence of the colouring matter and sulphur upon the bauxite. To check this hypothesis they then treated strongly coloured and sulphurous kerosenes with variable quantities of bauxite, and traced curve) giving in *abscissæ* the quantities of bauxite used (lb per gallon. and in ordinates the percentages of sulphur and colour removed The curves show that the coloured compounds are absorbed more rapidly than the sulphur, the elimination of which takes place regularly as soon as the greater part of the colour has been removed. The consequence of this new test shows that bauxite preferentially eliminates colour first and then sulphur.

This observation has a practical value where oils must have a particular chemical purity like pharmaceutical vaselines or vaseline oils used for internal administration.

Action of Bauxite upon Cracked Spirit.

The English paper examines the action of bauxites on certain compounds contained in hydrocarbons originating from cracking.

The authors having noted the opposite effect of bauxite on cracked spirits, recognised that the latter gave rise, when in contact with bauxite, to the formation of soluble, gummy, polymerisation products, the boiling point of which, however, was higher than that of the major part of the spirit treated.

By passing the spirit—no longer through cold bauxite—but through bauxite maintained at about 200° C., they obtained a condensate without colour and without sulphur, analogous to that which could be obtained by the redistillation of coloured and sulphur-containing spirits originating from cold filtration through bauxite. The earth, in a cold state, acted chemically in producing compounds which were only retained in part, the rest remaining in solution in the spirit.

A variation of this method was then applied in the purification of spirits and cracked petroleums. In the first place it consisted in bringing about polymerisation of the latter by passing them through bauxite filters maintained at 100/130°, and afterwards completing the operation by passing the filtrate, when cold, through cold filters, where the polymerised and condensed products were retained. By operating in this manner with a crude kerosene containing 0·310 per cent. of sulphur and by filtering first of all through hot bauxite and then through cold bauxite, it was possible to reduce its sulphur content from 0·310 to 0·260 after hot filtration, and from 0·260 to 0·160 after cold filtering.

The proportions of bauxite used being 1 lb. per gallon in respect of both filtrations.

Now, a cold filtration over an equivalent quantity of bauxite only reduced the sulphur content to 0·210. There was therefore an advantage to be gained in operating in the manner pointed out by the English authors.

Let us mention that in 1905 we pointed out this polymerising action of clays on shale spirit, and that this action has been utilised in the Hall process of refining cracked spirits obtained by this process.

The Advantages of Methodical Filtration.

Let us now endeavour to sum up the best conditions under which filtration through bauxite can be effected, according to Dr. Dunstan and his colleagues.

According to them the foreign matter contained in an oil may be of three different kinds:—

(1) In the condition of coarse particles in suspension in the oil.
(2) In solution.
(3) In a state of colloidal suspension.

They consider that sulphur compounds are in a state of solution ; whilst the colouring matter is in colloidal suspension. Working upon these hypotheses the English technologists imagine three theoretical layers in an ideal filter charged with bauxite, filtration taking place downwards, the first zone serving to retain the matter in mechanical suspension, the second zone serving to collect the matter in colloidal suspension (colour), whilst the third stage acts upon compounds in solution (*i.e.*, those containing sulphur). In practice, these stages will be attained a great deal more regularly by making use of a series of small filters rather than of one large filter.

By operating with such small filters one may successively eliminate those in which the bauxite has lost all useful effect, and replace them with filters of fresh bauxite, which come in at the head of the series.

This is at least the English idea.

In reality, the advantages of filtration in series in an infinite number of small filters are due to quite another cause, which we shall examine later on, and in our turn, in an article specially devoted to the operative methods of filtration.

However, this system of division has allowed the authors to confirm that the sulphur, or to be more exact, the organic compounds of sulphur, were only taken off regularly and completely after the total disappearance of colour. In support of this affirmation they give the following table resulting from a test made in a series of filters in which the filtrate of the one was successively passed into the other and so on, as is regularly done in practice.

No. of filters.	Colour "Saybolt" of the filtrate.	Sulphur content of the filtrate.	Sulphur, per cent. of the total adsorbed by the bauxite.
1	16° C.	0·286	8
2	17°	0·286	0
3	18°	0·286	0
4	19°	0·252	19
5	22°	0·129	60

This table shows that during the passage through filters 2 and 3, a slight decolorization took place whilst the sulphur-compounds were not being adsorbed. But the figures of column 4 do not exactly express the results indicated by the heading of the column ; the passage through filter 5 has lowered the sulphur content from 0·252 to 0·129, that is to say, by 0·123, which is equal to 50 per cent. of the original content, and not to 60 per cent.

The same remark applies to filter 7.

Simultaneous Use of Different Products.
(Bauxite, Floridine.)

Having confirmed this fact, the English authors had the idea of placing on the top of their bauxite filter an earth commercially known as "Florida Earth," and well known for its decolorizing power in all petroleum refineries, and even vegetable oil refineries. This Florida earth is used to a great extent in America for the decolorization of cotton oils, which they thus manage to make perfectly white and neutral in taste, and, consequently, suitable for fraudulent adulteration of edible oils which is so common a practice in this industry.

By operating in this manner the English discovered that Floridine, which decolorizes better than it desulphurises, might advantageously prepare the oil for the desulphurising role of bauxite.

The table given below condenses the results obtained by measuring the volumes flowing from the filters, charged with a mixture of bauxite and of Florida earth, until the filtrate gives a positive reaction to sodium plumbite; *i.e.*, until the content of the filtrate in sulphurous compounds is such that it furnishes a reaction indicating the practical exhaustion of the filter.

Weight of bauxite forming the charge of the filter. gr.	No. of c.c. run off until the reaction with plumbite of soda takes place. cm³.	Weight of bauxite and floridine forming the charge of the filter (bauxite, floridine).	No. of c.c. run off till reaction with plumbite of soda takes place. cm³.
1			
10	75	10+0	75
11	82	10+1	90
12	90	10+2	110
13	97	10+3	120
14	105	10+4	130
20	150	10+10	120

What do these results prove? The English do not say, but they decide on the use of limited quantities of Floridine not exceeding 20 per cent., since beyond 30 per cent. an opposite effect is produced to that which might be expected.

This fact has been verified by the following experiment :—

Quantities of bauxite or of the mixture.	Pure bauxite.	Bauxite 83 per cent. Floridine 17 per cent.
6 lb. per gall.	Sulphur in the filtrate 0·122	Sulphur in the filtrate 0·090
3 lb. ,,	Sulphur in the filtrate 0·163	Sulphur in the filtrate 0·140

in respect of a kerosene containing 0·269 per cent. of sulphur.

In our turn we draw different conclusions from these results by transforming them into curves in the figure 2. The curves show first of all that, during the operations, the filtered volume of products, not giving reaction to plumbite, is proportionate to the weight of earth used, which is logical, but incompatible with the law of Freundlich.

As regards the sudden reduction in yield from the filter beyond a certain proportion of Floridine, we attribute it to quite a different cause. This effect, in our opinion, would be the defective working of the mixed filter beyond a proportion of Floridine, this earth containing an important proportion of excessively minute granules which are capable (beyond a certain amount in the filter) of choking the pores of the bauxite or of hindering its absorbent action. But, for want of further details, we shall leave the matter there as regards the analysis of the subject.

Influence of the Age of Distillates on their Decolorization by Bauxite.

There still exist certain anomalies, confirmed by Dr. Dunstan and his collaborators, which take place when one filters coloured products originating from distillations made at different times.

According to these authors, it appears that distilled products are much more readily decolorizable the older they are. That is to say, that in the course of time there is produced a sort of agglomeration of the coloured compounds supposed to be in a colloidal state. By operating on coloured samples of kerosene, the age of which is expressed by the numbers in column No. 1, they obtained the following results :—

Time expired after the distillation of the kerosene (days).	Per cent. of sulphur in the filtrate.	Colour of the filtrate in Saybolt degrees.
0	0·116	14
5	0·110	15
10	0·86	16
21	0·83	19
31	0·102	21

It must be presumed that these tests were rigorously carried out under the same conditions, which is difficult in practice in the matter of filtration, but easier by agitation.

However, their observation is justified, except as regards the last result in which the coloration still decreases with increase in age, whilst the sulphur content rises.

We shall place this anomaly to the account of the filter and we shall remember that, towards 1912, we pointed out, in the *Revue des Matières grasses*, two anomalies which may be allied to this observation.

Then it concerned heavy Roumanian distillates, solar oils (from Bustenari) distilled industrially with the aid of superheated steam.

We found that these distillates, which were absolutely colourless, immediately after distillation turned yellow when protected from light at the end of a certain time, but that this colour readily disappeared by a short exposure to sunlight. We then supplied

the following explanation of these phenomena. It is known that during a steam distillation small quantities of liquids may be carried over from the still in the form of mist not very soluble, and not affecting the colour of the distillate so long as their solution is not complete, which requires a certain time. We confirmed this first of all. But it is likewise known that certain bitumens, dissolved in certain spirits, have the property of their becoming insoluble on exposure to sunlight.

This property is used in engraving. In the second part of the experiment, by submitting the solution to the action of solar light, we rendered the entrained bitumen insoluble, and these minute particles, being very widely dispersed, no longer coloured the liquid.

And, to prove our hypothesis, we obtained confirmation, some time after, that distillates manufactured in this manner were capable of remaining colourless once they had been agitated with a small quantity of dry clay, sufficient to retain these soluble colloidal materials.

It may, therefore, be that the samples examined by the English, at an interval of some days, have been preserved in bottles exposed to the light, and that, under these conditions, a part of the colour has been able to disappear from this fact. Figures indicating the colour of the distillate before filtration are necessary in the above table for one to be satisfied regarding the real value of the results.

It is true that these phenomena of decolorization by light are sometimes obscured by phenomena of coloration due to the formation of products which settle at the end of a certain time in the form of resins or gums.

Regarding the Determination of the Qualities of Bauxites (Ergometer).

All the results which have just been analysed do not take into account the texture and the structure of the bauxites utilised at the time of the experiments, which, from this fact, run the risk of not being comparable. It is a reproach which we would readily have made to the operators if we did not agree with them as to the difficulty of establishing the quality of a bauxite.

One knows in practice that bauxite is so much the better when it is hard and porous, and still more so when its pores are very minute.

The best means to judge the quality would, therefore, in theory, be to examine its apparent density, which the Germans claim for their silica gels (*Petroleum Times*, August 15, 1924). But in practice the best way to judge the quality of a bauxite is to test it, but to test it on a large scale. The English authors have confirmed, like

ourselves, what great difference there is between laboratory tests and industrial tests, the laboratory tests through small filters being capable of giving absolutely different results from those obtained in practice with large filters.

And, it is regrettable that these authors should not have sought, as we did, the exact causes of these differences, which we hesitate to publish, so curious and original are they—*i.e.*, suitable as secret processes of manufacture. This state of things is still more regrettable when one thinks of desiring to supervise, for example, the progress of the delicate operation of roasting, or of elimination by heat of a suitable degree, liquid or gaseous compounds retained in the pores of the bauxite or of similar decolorizing earths like clay and floridine.

However, the English have discovered a fairly rapid means of judging, in the laboratory, the decolorizing or desulphurising value of decolorising earths, and notably of bauxites. The means is simple : it consists in measuring the rise of temperature which is produced when bauxite is brought into contact with coloured and sulphur-containing oils. In order to measure this rise of temperature they have made use of a simple apparatus composed of a metal cylinder 1¼ ins. in height and of equal diameter capable of containing about 50 gr. of bauxite of 20/90 mesh.

In the cylinder filled with bauxite a thermometer is plunged, the reservoir of which occupies the centre, and the temperature is read. They then add 20 c.c. of the kerosene to be decolorised and desulphurised, letting it flow through four small holes pierced in the cover. A very appreciable rise in temperature then takes place, which they call *the ergometer number*. With this apparatus, called "Ergometer," for what reason it is not known, Dr. Dunstan and his colleagues have established a series of facts which are really very interesting.

A bauxite of good quality gives an *ergometer number* equal to 16° C. (with a particular oil probably), whilst this same bauxite, after use and regeneration by roasting, only gives 12° or 14°.

As we shall see further on, this number will decrease with bauxites too rich in dusty material, which fact indicates the very marked importance of the size of the grains of bauxite, a factor left, so far, too much in the shade. Naturally, the rise in temperature measured is the maximum rise which takes place. With this instrument—evidently very simple—the English have first of all sought the relations which may exist between the temperature of the roasting, the humidity taken away by the latter, and the decolorising and desulphurising power. They have proved, it is to be noted, that the desulphurising properties were approximately proportional to the *ergometer numbers*.

This number appeared to be at a maximum with different qualities of bauxite when roasting was carried on between 400° and 500° C. (see following table).

Temperatures of roasting.	Ergometer numbers obtained with different bauxites numbered 1 to 6					
	1.	2.	3.	4.	5.	6.
0 ..	—	0·1	—	1·1	0·8	0·8
300° C. ..	—	12·6	—	10·3	5·8	—
400° ..	16·8	16·7	14·6	12·8	9·3	8·1
500° ..	15·4	15·3	13·3	11·4	8·6	—
600° ..	14·7	13·7	12·8	10·9	7·7	7·6
700° ..	13·0	11·2	—	10·7	7·7	—
800° ..	—	—	—	—	6·2	—
900° ..	8·2	8·8	—	6·7	—	3·6

The most favourable roasting temperature gives an *ergometer number*, which appears indeed to be a criterion of the value of this apparatus. According to the table below it would be between 400 and 500°. There you have a confirmation of the numerous experiments which we have ourselves undertaken from 1904 to 1912 with argillous earths obtained from the deposits at Vanves (near Paris), or at Saint-Loup-du-Naud (Haute-Marne) or at Vauclose.

The observation would therefore be general and independent of the chemical composition of the decolorising earths. The following table has been prepared from experiments (with the ergometer) carried out on bauxites, of which the humidity removed has been calculated by suitable roasting at 400°.

Quality of bauxites.	Moisture removed, at 400° C.	Ergometer No.	Sulphur removed.	Colour in Saybolt of the filtrates.
A	1·00 ..	1·0 ..	1·0 ..	18
B	1·10 ..	1·3 ..	1·0 ..	18·5
C	1·40 ..	1·4 ..	1·8 ..	19
D	1·90 ..	2·0 ..	2·0 ..	24
E	2·94 ..	3·0 ..	3·0 ..	24
F	2·90 ..	3·3 ..	3·0 ..	24
G	4·35 ..	4·6 ..	4·0 ..	25
H	4·42 ..	4·8 ..	5·0 ..	25
I	4·72 ..	5·5 ..	5·0 ..	25

Without any doubt the desulphurising power is proportional to the desiccation. The decolorising power increases, but in a more irregular manner, which one might perhaps explain, if one had a little more information regarding the conditions under which the filtrations are carried out, according to our general observation.

Bauxite Must be Utilised Immediately after Being Roasted.

In order to compare two bauxites, one must roast them, dry them and sift them, not only under the same conditions, but also by taking the precaution to re-cool them in closed vessels and so far as possible immediately after roasting. In order to show the

necessity of operating thus, Dr. Dunstan proceeded to make the following tests :—

A sample of bauxite roasted at 450° was divided, for example, into five portions cooled differently and tested by the ergometer after different periods of time :—

Portion No.		No per the ergometer.
1.	Cooled in a desiccator and used after 1 hour	11·7
2.	Used after 17 hours	11·5
3.	Cooled in the open air and used ½ hour after	9·3
4.	Used 6 hours after	8·0
5.	Roasted and preserved 2 years in a stoppered bottle	1·1
6.	The same as No. 5, but re-roasted at 400° and used immediately	12·8

These results are significant ; cooling must take place away from moist air, and they must be used at once.

Verification of Our Theory of Decolorization by the Ergometer.

The ergometer, which appears to give some very interesting results, has been tried not only to judge of the quality of bauxites, but also to measure the purity of petroleum oils, or more exactly their colour and sulphur content. This time, it was the qualities of the oils which were made to vary. The results, it appears, were not very interesting. They did indeed obtain different figures, according to the quality of the hydrocarbons tested, but without being able to draw from them any very reliable conclusions. Benzole gave them higher figures than petroleum, but still quite close together.

An identical bauxite tried with a crude or refined kerosene gave them the same *ergometer numbers*. The actions were, to tell the truth, not identical, but nearly similar.

Water added to the bauxite gave identical results and the *ergometer numbers* obtained with the same bauxites, were in like proportion.

Such are the conclusions of Dr. Dunstan and his collaborators.

Table of the Ergometer Numbers with a series of different Hydrocarbons.

Material tested.	Ergometer No.
Crude kerosene not treated	15·7
Kerosene :	
Washed with soda	16·5
Treated with bauxite at the rate of 50 lb. per gall.	15·8
Treated with hypochlorite	16·4
Treated with a treatment at 2 per cent. of C.O.V. and ½ lb. of bauxite per gall.	13·6
B.P. Petroleum No. 1	15·8
Shell Aviation Spirit	15·6
Cracked spirit originating from gas oil refined by hypochlorite and redistilled	15·3
Benzole	18·2
Xylol	17·2
Amylene	13·8
Paraffinum liquidum	6·0

If these results prove nothing to the English authors, they are, on the other hand, of considerable importance to us, for they very clearly prove the hypothesis which we enunciated in our treatise in collaboration with M. Haudricourt, and which appeared in 1912 in the *Revue des Matières Grasses*. Let us recapitulate these conclusions:—

By examining closely the figures in the table above, we see that the *ergometer number* for paraffinum liquidum is the lowest, and equal to 6, whilst that for benzole or xylol is the greatest and equal to 18·2 and 17·2.

This proves that, apart from their selective attraction for colours, the porous earths have a far greater one for the hydrocarbons rich in carbon (benzole, xylene) than for the hydrocarbons saturated with hydrogen (paraffins).

If we connect this to the fact that the *ergometer number* is higher for benzole than for xylol, and especially so with ethers rich in hydrogen, we see that our theory is proved, or more exactly that out hypotheses are probable. And, to be complete, we shall not omit to find in these results a very clear relation between the attractive properties of the earth and the dialectic properties of the liquids under consideration, and notably those which the treatment by chlorine or hypochlorites has certainly ionised.

As regards the variations of the *ergometer number* with loss of water on roasting, they explain themselves; a well-roasted bauxite necessarily having more attraction for water than one less dehydrated.

Material tested.	Roasting temp.	Ergometer no. for water.
New Skowen bauxite	not roasted ..	0·8
„	400° ..	28·0
„	650° ..	46·0
„	900° ..	33·0
French bauxite (Douai)	500° ..	8·0
Abadan bauxite	500° ..	83·0
Indian bauxite	500° ..	41·0
Bauxite (Hull, Blyth & Co.)	500° ..	12·5

Influence of the Size of the Bauxite Grains on Decolorization.

Dr. Dunstan and his collaborators then examined the influence of the texture of bauxites upon decolorisation and desulphurisation.

First of all, they proved that the fineness of the grain was favourable; but they were not long in remarking that this law applied only up to a certain maximum. Beyond a certain fineness, the refining capacity of bauxite became less.

With the bauxites examined, the mesh which was found to be best was 30/60. We hasten to state that this is a question of one particular bauxite, for the authors would certainly have arrived at other conclusions with other decolorising bodies.

Finally, they add that this fineness is excessive, and that it cannot be adopted in practice.

When the bauxite is too coarse there are produced between the grains, the English say, channels of less resistance to percolation—through which the oil flows without allowing time for adsorption to take place.

In order to avoid this inconvenience, they propose, therefore, to enlarge the limits of the sieve to 20/90, because under these conditions the small particles fill up the spaces between the large particles, and do away with these channels.

Influence of the Shape of the Filters upon Decolorisation.

The shape of the filters used is said to be of little importance, and, to prove it, comparative results are given with cylindrical filters in which relation of length to diameter has been varied, keeping the weights of bauxite identical, and passing through equal volumes of the same kerosene.

Relation of the height of the filter to the diameter.	Colour per Saybolt of the filtrate.	% of sulphur in the filtrate.
2/1	24	0·20
4/1	24·5	0·210
8/1	25	0·205
50/1	25	0·193

This table perhaps justifies the conclusions of the English authors, but cannot convince those who have worked industrially, starting not with kerosene, but with black residues of crude oils to be transformed into extra white vaselines.

If the English had studied the influence of the shape of the filters upon the commercial results of the treatment, they would have been able to see to what an extent this simple detail was of importance, especially if there was added thereto the influence of the method of heating of these filters when it is a question of viscous products. Unfortunately, these details come within the sphere of manufacturing secrets, so far jealously guarded by the vaseline manufacturers, whom we shall not blame for the moment, that is to say, so long as the empirical rules which we know of do not enter definitely into the domain of science. This problem we have been working at for some months, after a stoppage of twenty years.

The Influence of Speed in Filtration and of Temperature upon Decolorisation.

Speed of filtration, according to the English, would likewise seem to be a matter of indifference, according to the tests made

by filtering equal quantities of kerosene through equal weights of earth, and at speeds varying from 1 to 50.

Filtration speed.	Colour per Saybolt of the filtrate.	Sulphur percentage in the filtrate.
1	24·5	0·18
10	25	0·18
50	20	0·18

This result may be exact as regards the sulphur, which may be at once either rendered insoluble and retained or adsorbed, but it is certainly insufficient as regards the colour. We are definite upon this point as the result of long practical experience, and we know for certain that decolorisation is definitely a function of time, and this in no small degree.

As regards the temperature of reaction, it is very possible that it has very little influence as regards products which are not much coloured or not much charged with impurities capable of polymerising under the catalytic action of earths; but when we have to do with unsaturated compounds of the ethylenic kind, it is no longer the same thing, and temperature maintains its importance.

Besides, the English authors themselves have already recognised this action of temperature when they described the action of bauxite in two stages upon sulphur containing oils; first hot to polymerise and a second time cold to adsorb. Temperature is, besides, necessary, as they agree, not only to avoid the rehydration of the decolorizing earths in those parts of the filters not yet impregnated with oil, as in fresh filters. Moreover, the heating of the filters must be carried out in a special manner which the English appear to be ignorant of, being always preoccupied with the treatment of kerosenes and not of viscous and coloured oils, as one can see.

General Considerations upon the Regeneration of Decolorising Earths.

The roasting of bauxites either in their natural state or after use, demands certain precautions. It must be carried out in such a manner that the action of the heat may be uniform, and the roasting apparatus must necessarily permit an agitation contrivance.

Nevertheless, this agitation must not give too much dust, this being injurious to the proper operation of filtration.

Moreover, it is necessary that this roasting be carried out in the presence of air, especially when it is a question of used earths highly impregnated with the adsorbed material.

The air helps, in effect, to produce combustion of the organic materials which fill the pores of the bauxite. If one were to

operate in absence of air, these organic compounds would inevitably leave carbon deposits which would obstruct the pores and would be injurious to the quality of the regenerated bauxite. This observation is perfectly true. We made it previously ourselves in comparing this roasting with the operation of calcining bones in which case, on the contrary, it is necessary to operate in closed vessels in order to preserve the carbon which serves as a skeleton for the phosphate of lime, the removal of which by means of acid washings clears the pores of this skeleton, giving those very active substances known as "washed blacks." And this is why we ourselves recommended as a very good roasting oven, the old drying rooms with a dull fire of the oil refineries manufacturing seed oils, modifying the weight of the millstones in order to avoid too intensive crushing, but, nevertheless, necessary especially in the case of used earths which agglomerate at the start of the roasting.

Besides, the inconvenience of producing "fines" when clay is employed may be very easily removed by dressing and moistening of the "fines" which are thus transformed into a paste, which it is sufficient to have slowly re-dryed and re-roasted.

The English have found that this roasting of the used earths was absolutely necessary, and could not be replaced by the different processes of treatment by petroleum, alcohol, acetone, benzole, ether, carbon, tetrachloride or by washings with solutions of carbonate of soda, hydrochloric acid, or finally by treatments with superheated steam at high pressure.

It is however necessary to make a distinction between this roasting operation, and that which consists of recuperating the greater part of the greases or the oils impregnating the clayey earths, bauxites, silica gels, etc. In any case the roasting operation must be preceded by an extraction of the material impregnating the filtrating bodies which have a real value.

This extraction, as we have shown in the numbers of the Matières grasses of January, February and March of 1924, is of extreme importance from the point of view of the cost price of the decolorisation.

The material impregnating the filtering bodies ordinarily costs (at least in France) much more than the impregnated body itself. It is for this reason that the different processes of extraction and washing with the solvents mentioned above are interesting and must always precede the final roasting, which has as its sole purpose the regeneration of the filtering medium. However, there are judicious selections to be made amongst these processes when one wishes to operate in a methodical manner.

We have demonstrated, for example, that an earth coming

from a used filter, i.e., one which no longer has any action on the material passing through it, could be treated in two different ways:—

The first consists in removing all the fatty material by appropriate solvents, dissolving the whole of the oil and colouring matter. The second consists in taking off first of all the oils filling the spaces between the decolorising grains, then taking away the adsorbed parts, *i.e.*, those impregnating the grains of bauxite or clay.

To operate in one or the other manner, it will be sufficient to take note of the remark which we made regarding the insolubility in petroleum spirits of the compounds ordinarily retained by the clays, since these are readily extractable by benzole or by chlorinated hydrocarbons such as chloroform or carbon tetrachloride. Consequently, when it is desired to wash the clays before roasting, it is always advisable to treat them with petroleum spirit or lamp oils of the paraffin series, which will remove the original oils but leave in the mineral mass the colouring elements which will be destroyed by roasting.

At this point, we will reserve a few lines to make a remark *en passant*, regarding new methods of washing porous earths impregnated with oils by means of aqueous saline solutions. According to the experts who have studied these processes the saline solutions act by means of the property which they possess of having weak surface tensions *vis-à-vis* solid bodies, and of being at the same time ionised solutions and very good conductors of electricity.

Thanks to these different physical properties the solutions have a higher affinity for clays, bauxites and silicas than have mineral oils. One can even explain by these considerations how electric energy may intervene in decolorisation, furnishing a new proof to the partisans of the electric theories to which we made reference at the very start, and which henceforth we must consider with extreme attention.

Regarding the Poisoning of Regenerated Decolorising Bauxites.

All the experts have remarked that the decolorising earths finished by losing their power after several regenerations. They have attributed this loss of power to different causes, such as an actual case of poisoning by compounds of sulphur or chlorine. We have ourselves thought for a very long time that this loss in activity was due to the increasing obstruction of the "fines" of the decolorising earths. In order to seek the causes of this alteration noted in bauxites, the English proceeded with successive exhaustions and regenerations, and they obtained the following results:—

Bauxite.	Colour per Saybolt of the filtrate.	Sulphur of the filtrate.
New	18 ..	0·220
After 1 regeneration	17 ..	0·200
„ 2 „	16 ..	0·230
„ 3 „	13 ..	0·190
„ 4 „	15 ..	—
„ 5 „	15 ..	—
„ 6 „	17 ..	0·230
New	20 ..	0·180
After 1 regeneration	18·5 ..	0·190
„ 2 „	18 ..	0·190
„ 3 „	17 ..	0·190
„ 4 „	17·5 ..	—
„ 5 „	18·5 ..	—

If one examines the figures contained in this recapitulative table, one might almost say that bauxite is indefinitely capable of regeneration, indeed, even that in certain cases it is better after regeneration than before, especially in the case of sulphur. Moreover, the analyses below of new bauxite and that regenerated 20 times show that the chemical composition does not vary with regeneration.

	Analysis of	
	New roasted bauxite.	Bauxite after 20 regenerations.
SiO^2	1·59 ..	1·57
$Al^2O^3+Fe^2O^3+TiO^2$	97·26 ..	96·94
SO^2	1·15 ..	1·49
Fines passing through the sieve :—		
No. 60	3% ..	28%
No. 90	0·5% ..	12%
Number of ergometer	14·5° ..	9·4°

Thus, according to Dr. Dunstan and his English collaborators, the only causes of the decrease in the activity of the bauxites would be the crumbling of the grains—a crumbling which can be remedied by the addition of a little new bauxite after each roasting operation, or by a suitable sifting.

Influence of the Duration of Roasting upon Decolorising Bauxites.

The influence of the period of roasting has likewise been examined upon an identical sample roasted in a muffle on a dish (experiments 1 and 5), as well as in a tube heated on the outside, and into which a current of air was passed (experiment 6). The results of these tests prove that the action of the air is evident and distinctly favourable.

Material.	Roasting temperature. ° C.	Period of roasting (in hours).	Number of the ergometer.
New bauxite	500 ..	1 ..	15·4
(1) regenerated once ..	500 ..	1½ ..	12·9
(2) „ twice ..	500 ..	4 ..	12·5
(3) „ 3 times ..	600 ..	1/2 ..	12·7
(4) „ 4 „ ..	600 ..	1½ ..	13·0
(5) „ 5 „ ..	600 ..	3 ..	14·6
(6) „ 6 „ ..	600 ..	2½ ..	15·1

The increase in time of roasting is likewise favourable, but within restricted limits.

Influence of Chemical Agents upon Decolorising Bauxites.

Preliminary treatment of bauxite by certain chemical reagents would be, it appears, rather injurious than useful, if we judge from the results below :—

	Roasting temperature °C	Duration in hours.	Ergometer numbers.
New bauxite without treatment ..	500	1	15·4
Bauxite treated with HCl. dilute ..	550	1	9·3
Bauxite treatment with ammonium phosphate	450	1	8·9
Bauxite treatment with ammonium phosphate	650	3	6·7
Bauxite treated with caustic soda ..	600	1½	8·8
Bauxite treated with caustic soda and washed in running water for six hours	600	2	10·2

Influence of Roasting Temperature on Decolorising Bauxites.

On the other hand, the roasting temperature, as has been indicated several times already, has considerable influence both upon the power of decolorisation and upon the stability of the products filtered, which change more or less slowly under the action of light and air according as they have been treated by bauxites, the roasting of which has been more or less prolonged.

Roasting temperature.	Ergometer number	Percentage of humidity left.	Colour per Saybolt.	% Sulphur removed.	Effect after 9 months' sunshine and air upon the filtrate.
No roasting ..	0	—	—	—	—
200° „ ..	0·5	26	3	—	—
300° „ ..	5·0	9·7	20·0	24	Dark gum on the sides of the bottle
400° „ ..	14	4	23·5	48	Yellow without gum.
500° „ ..	9	1	22·5	58·6	Still more gum than at 300°.
600° „ ..	7	0·68	21·5	65·6	„
700° „ ..	7	0·34	21·5	61·2	„
800° „ ..	6	0·32	20·5	—	Yellow as at 400° and gum as at 500°.
900° „ ..	4·50	0·00	20·0	40·3	Dark colour abundant gum.

Thus the most favourable roasting temperature would be 400°. Above this temperature of 400° there would be a slightly less decolorisation, and the production in the filtrate of compounds which

finish ultimately by forming insoluble resins under the influence of air and sunlight. This table verifies at the same time the value of the information supplied by the ergometer.

Extent of the Influence of the Size of Bauxite Grains upon Their Decolorizing and Desulphurating Powers.

The size of the grains—as has been recalled several times—has a considerable influence upon the results of the treatment of oils by decolorizing earths. The English admit that compounds containing sulphur are in real solutions, whilst the coloured compositions would partly be in solution, and partly in a colloidal state. Therefore they conclude that the phenomenon of the decolorization is specially connected with the fineness of the grains which act by means of their external surfaces, whilst the desulphuration is a function of the interior surface of the pores; *i.e.*, of the length and diameter of the pores which run through the grains.

The table which follows gives some interesting information in support of this theory:—

Size of grains Nos. of meshes.	Percentage of total sulphur taken off by		Colour per Saybolt of the filtrate by	
	Agitation	Filtration	Agitation	Filtration.
10/20	25	—	—	—
	23	—	13	17
20/30	31	33	17	17
	31	—	—	—
30/60	33	—	—	—
	32	37	19	21
60/90	30	32	21	23
90/180	25	—	—	—
	24	—	22	—
Above 180	24	—	22¼	—

This table does not indicate how the experiments have been carried out. We shall suppose that on each occasion there has been used an equal weight of bauxite in the case of agitation as well as filtration. Under these reservations we indeed find an increase in desulphurisation—admittedly rather slow—with increasing fineness of the bauxite; *i.e.*, of the total external surface of the grains, the action becoming less beyond a certain degree of fineness corresponding to the mesh 30/60. To what can this sudden variation of the influence of fineness upon desulphurisation be due? In our opinion this variation would seem to indicate that desulphurisation is defective in pores which are too long, perhaps because the latter require too much time to be traversed, or because they get blocked up; whilst channels which are too short do not act a sufficiently long time upon the products containing sulphur.

But, this table shows incidentally that the filtration process—when it is possible—requires a great deal less bauxite so long as the size of the grains permits of its use. There you have an interesting

fact to keep in mind with regard to the practical application of this method of refining. Outside of these conclusions, one had likewise to keep the fact in mind that the adsorbent powers of the bauxite grains are likewise variable and that they increase with fineness. Now, one has here a complication which must be taken into account when the regeneration of bauxite by roasting is attempted.

There was, besides, another means of noting the influence of the size of the grains, viz., that which consisted in measuring the *ergometer number* of bauxite of different mesh. These tests were carried out by the English and have given the following figures:—

Mesh of the bauxite.	Number of the ergometer.
Held on mesh 10	7·5
Between 10 and 20	9·1
„ 20 „ 30	13·4
„ 30 „ 40	15·7
„ 40 „ 60	15·3
„ 60 „ 70	15·6
„ 70 „ 90	15·6
Passing 90	12

The results of this table are more exact than the previous ones; in particular, they show that the maximum action extends over a fairly wide range of size of grains, being from 30 to 90 mesh. It is only beyond this that the ergometer number falls; but how does it fall? It is regrettable that this "beyond 90" which still comprises an infinite number of finenesses has not been studied, for the constancy of the *ergometer number* between the meshes 30 and 90 cannot disappear so suddenly beyond 90 without a real cause. Because of this low *ergometer number* it is regrettable that the English have not pursued their investigations, seeking, for example, to expose the exact *rôle* of the impalpable portions in bauxites of well-defined sizes. The *rôle* is certainly very active, as they may be able to find out in their future work on mixtures, but this time of well defined degrees of fineness.

INFLUENCE OF THE COMPOSITION AND THE TEXTURE OF THE FILTERING LAYERS. CURIOUS PROPERTIES OF LEUCITE SILICAS.

We ourselves have lately confirmed, in a very striking manner, the influence of the size of grains in operations connected with the decolorization of black mazouts filtered through residual silicas obtained by the acid treatment of Italian leucites according to the process of the Italian Professor E. Blanc. We anticipate returning, besides, to these tests which led us to very curious results. But we can already say that we have verified this: viz., that the decolorizing powers of silicas from leucite not only vary with the fineness of the grains, but with the composition of the mixture of grains of different sizes, and their manner in which they exist in this mixture.

Now, we shall recall here that these grains of silica from leucite have a very original structure due to their method of preparation. In effect, these grains are the result of the action of dilute solutions of hydrochloric acid upon the leucite grains. Their exterior surface is, in reality, formed by a membrane of silica which was formed at the time of the attack on the grain, and which, in consequence, mechanically opposed the departure of the gelatinous silica held in the interior, only allowing the soluble salts of potassium chloride and aluminium chloride to pass.

Each grain of residual silica from leucite is therefore formed of a kind of closed silica bag forming a continuous envelope containing the porous silica in an extremely divided form corresponding to the silicous skeleton of the original grain. If therefore we break these grains we shall offer to the oils to be treated, not a coarse and continuous surface, but fractured surfaces through which the suspended or colloidal matter will penetrate to be retained there, that is to say, adsorbed. Indeed, tests have proved these suppositions, since grains of leucite, which originally only had a very feeble decolorizing power, gave, after crushing, very good decolorization results. But the fact which struck us most was that two filters charged with an identical weight—the first with silica from leucite simply crushed and the second with this silica from leucite passed through a sieve and put in successive fine and coarse layers—did not give the same results. This, then, is what caused us to make the remark just now relative to the variation in power of the mixtures of fine and coarse bauxites. We therefore propose, later on, to explain the results by making use of the ergometer.

Action of Vacuum upon the Decolorizing and Desulphurising Power of Bauxites.

Fineness is not, therefore, always an advantageous property, as regards decolorization, especially when to this is added the inconvenience of filters loaded with too fine earths, which prevent the filtration of the oils. This inconvenience with vaseline residues is even so serious that it compels manufacturers to throw out this debris which they then endeavour to re-agglomerate, as in the case of clays.

It is therefore natural that an endeavour has been made to overcome this resistance to passage of the oil by mechanical means, either by applying pressure above the filter or by producing a vacuum below the filter.

This first idea introduced that of evacuating before use the pores themselves of the decolorizing earth. The English authors therefore sought to find out what would be the action of pressure tending to force the liquid into the pores of the porous material previously deprived by vacuum of their gaseous contents.

Experiments were made with bauxites impregnated beforehand with oils and afterwards submitted to pressures varying between 140 to 240 lbs. per square inch (7 to 17 kilos.).

These experiments were carried out at first in a Mahler bomb under nitrogen pressure (nitrogen being considered as an inert gas).

No visible result was noted.

Pressure exerted upon the mixture of bauxite and petroleum.	Percentage of sulphur in the filtrate.
Atmospheric pressure	0·05
„ 100 lbs. per sq. in.	0·04
„ 240 „ „	0·04

Other experiments were attempted by taking a filter to which pressure was applied by means of a U-tube filled with oil and attached to a steam boiler working at 100 lbs. per sq. in. As the filtration speed was an important factor it was regulated by a valve; the following results were obtained:—

	Under 100 lb. per sq. in.		Under atmospheric pressure.	
Sulphur in the filtrate ..	0·15 ..	0·22 ..	0·13 ..	0·19
Colour of the filtrate ..	22 ..	22 ..	23 ..	23

These results prove that the pressure here does not give any advantage. Another series of filtration experiments was carried out in a tube capable of being heated to the roasting temperature of bauxite, and supplied with special taps. This tube, filled with bauxite, was roasted open to the air, then cooled under a vacuum of 2 to 3mm., and the oil was introduced in such a manner as to impregnate the bauxite. After a rest of five minutes under these conditions, the impregnating liquid was drawn off on a vacuum filter. An identical experiment was then made without using the vacuum.

These two tests gave the results given below:—

Sulphur in the Filtrate.	
With the vacuum.	Under atmospheric pressure.
0·077	0·137
0·070	0·135

It therefore appears advantageous to start with bauxite not only roasted, but which has had the pores deprived by vacuum beforehand of the occluded gases.

These experiments were repeated on the larger scale with the following results:—

	Under vacuum.	Under atmospheric Pressure.
Sulphur in the first 50 c.c. filtered	0·049 ..	0·040
„ „ second 50 „ „	0·067 ..	0·077
„ „ third 50 „ „	0·132 ..	0·140
Averages	0·095 ..	0·099

This time it is clear that there was no noticeable difference between the results obtained by the two methods. The previous emptying of the pores of the filtrating material perhaps has a favourable influence; but the quickness of absorption of the gases by the pores is so great that, in practice, it is industrially impossible to utilise the advantage proved in the laboratory where one is able to act more quickly. Without any doubt it would be very important to produce an industrial process which only allows the arrival of the oil on the bauxite when the latter is still in the state in which it was after roasting and cooling by vacuum. In the first experiment the cold bauxite rose in temperature to at least 40° C., when impregnated with cold oil in a vacuum, whilst the ordinary ergometer reading was obtained when the impregnation was carried out after having let the air penetrate into the pores of the bauxite.

This latter experiment therefore permits one to judge the interest there would be in industrialising the laboratory method. Besides this, the English chemists noted other differences relative to the colour of the filtrates, to their smell, and also to the colour of the bauxite according to whether one worked in vacuum or in the open air. There is, therefore, in this connexion, quite a series of experiments to be attempted—studies which are capable of being of the greatest scientific interest.

Conclusions.

Such are—analysed and criticised—the different observations made by Messrs. A. E. Dunstan, F. B. Thole, and F. G. P. Remfry. (It will be noted before any discussion that the numbers employed in this paper expressing the colours go on increasing when the colour diminishes; there you have rather an illogical manner of expressing what it is desired to say, but it is the method of the inventor of the Lovibond Colorimeter. One will do well likewise to beware of what is intended by the number of meshes per square inch in the sieves used by Dr. Dunstan and his collaborators.)

What must one conclude therefrom? In the first place that this study is extremely useful, and that it opens up the way to quite a series of researches upon bodies physically analogous to bauxite; we have quoted some in the course of this analysis (charcoals, silicates of alumina, precipitated silicates, and quite a series of analogous bodies). It would, indeed, be very interesting to prove whether the more or less exact laws applying to bauxite may be generalised upon all these other more or less porous bodies. But, in our opinion, it would be important—before commencing such a task—to define exactly the method of testing and the apparatus to be employed in order that all the results obtained from different sources and in different countries might be collated and serve for the abstraction of useful deductions, as only the latter could rapidly

advance the establishment upon a proper footing of a quite new refining technique.

We would not like to make a reproach of any kind whatever to the authors of this paper, necessarily incomplete, since it is only the first step in a new science.

These authors will, however, permit us to point out to them the extreme interest which would be presented—even with one particular bauxite of known composition—by continuous studies, no longer upon light lamp oils—usually only very slightly coloured and with which one can always employ agitation—but also upon lubricating oils and residues.

Already a number of technologists—amongst whom one may mention Hall, Day and ourselves—have attempted to utilise the properties of certain earths, complex silicates, in the treatment of the products derived from cracking or those containing unsaturated hydrocarbons, such as shale oils. Might not also coal and lignite oils be included?

These experiments would naturally necessitate very special precautions, to which, in our opinion, the English authors have not attached sufficient importance. By this we mean the composition itself of the filter and the technique of filtration.

In this domain there is indeed quite a field of exceedingly vast studies, full of promise and surprises. It would be useful, therefore, to make use of the microscope from time to time.

In the course of this analysis we have devoted ourselves to drawing from the tests of Messrs. Dunstan, Thole and Remfry, deductions and conclusions which former experiments allow us.

We hope that they will not be displeased with us for having thus attempted, not to criticise their fine study, but on the contrary, to show certain consequences from it which might have escaped their notice. Besides, as we have said several times, we propose at an early date, and if we see the possibility of it, to publish, in our turn, a series of personal observations upon this method of refining.

We are, indeed, convinced that these new methods of treatment, which have remained too long empirical and mysterious, are called upon to play an important *rôle* in the future petroleum refining industry. Having been devoted for many years to the cause of scientific refining—scientifically organised—we ardently desire that studies should continue in all countries in a spirit of sincere and loyal collaboration, and it is on the basis of this wish that we shall conclude our analysis.

The Vapour Pressure of the Crude Oil of Maidan-i-Naftun and of its Products.

By W. H. Cadman, B.Sc., A.I.C., F.C.S.

In the Journal of the Institution of Petroleum Technologists, 1924, Vol. 10, No. 41, Dr. A. E. Dunstan gives an interesting account of the crude oil of this Persian oilfield, and includes all that was known at that time of its chemical and physical properties. As a supplement to this paper, and in view of its great practical importance, it was decided to determine the vapour-pressure-temperature curves of Persian crude oil. The experimental results cover temperatures ranging from 50° to 160° F. The curves should not be extrapolated for more than about 10° F. beyond the limits of the experimental determinations.

Method for accurately measuring the true vapour pressure.

Comparatively little work has been done in measuring the vapour pressure of liquids other than definite chemical compounds. The simple standard method prescribed by the U.S. Bureau of Explosives in connection with the shipment of gasoline and casing-head products does not pretend to give scientific vapour pressure measurements, but purely arbitrary results. The values at 100° F. (or 90° F. from November 1 to March 1) do not agree with those obtained by other methods, such as that of Dr. R. P. Anderson of the American Petroleum Institute. The differences are so wide in the United States that a commission was appointed on August 7 of this year to study the whole question and make comparative tests. The research dealt with in the present paper was in progress at the time this technical commission was appointed at Chicago.

Before commencing this investigation the bibliography of the method used by other workers was carefully considered. A list of these publications is appended to this paper for reference purposes.

With a complex liquid hydrocarbon the determination of the true vapour pressure is complicated by the presence of dissolved air and other gases, and by the varying volatility of the fractions of which it is composed. Any attempt to remove dissolved gases by previous boiling introduces errors of considerable magnitude.

Even attempts to remove the air and fixed gases by cooling the liquid and evacuating the air with a good vacuum pump only proved to be partially successful, and always resulted in a loss of the more volatile constituents.

Another source of possible error lies in the assumption that a space above the liquid will be saturated with its vapour in a limited time, of say 10 minutes, at different temperatures without stirring.

Preliminary experiments proved that under such conditions considerably longer periods were often necessary before a constant maximum vapour pressure was registered.

A modification of the method devised by H. T. Tizard and A. G. Marshall was finally decided upon and proved to be very satisfactory. This method ensures that the vapour pressure is measured under such conditions that evaporation does not alter the composition of the liquid phase. This is a most essential point, and one frequently overlooked by other methods.

The liquid is first allowed to stand over calcium chloride to remove any water that it may contain. In this way the partial vapour pressure of water is eliminated. It is important to dry the liquid before use since the saturation vapour pressure of water varies from 9·2 mms. to 234 mms. between 50° and 160° F.

Apparatus and procedure.

The photograph (Fig. 1) and diagram (Fig. 2) show the apparatus used. It differs from that of Tizard and Marshall by including a stirring device which was found to be a decided improvement and greatly reduced the time required to register the maximum vapour pressure exerted at any temperature. An iron stirrer was introduced into the cylindrical bulb of the apparatus before sealing to the connecting tubes. This could be moved up and down by means of a horseshoe magnet, which was raised and lowered outside the bulb by a simple mechanical device worked by hand or motor. The magnet is immersed in the water bath during an experiment and consequently serves at the same time as an efficient stirrer of the vapour and liquid within the bulb and of the water surrounding it. With this attachment a constant pressure is quickly obtained, usually within five minutes.

The method of working the apparatus and of taking measurements is in other respects exactly as described by Tizard and Marshall in the Journal of the Institution of Petroleum Technologists, Vol. 8, No. 31, 1922, pp. 217—223. Detailed instructions are not given in the paper referred to, and are, therefore, included in this paper. It was soon found that vaseline and vaseline-rubber lubricants could not be used to lubricate the tap leading from the burette to the bulb on account of air leakage as soon as the tap had been turned a few times. After substituting soft soap for the vaseline lubricants in the experiments on petroleum oils no further leakage troubles were encountered.

The whole apparatus except the manometer and barometer tubes was enclosed in an asbestos screen to eliminate disturbing air currents. The lagged copper thermostat in which the bulb was immersed was of five litres capacity and was provided with two glass windows. The temperature of the bath was maintained

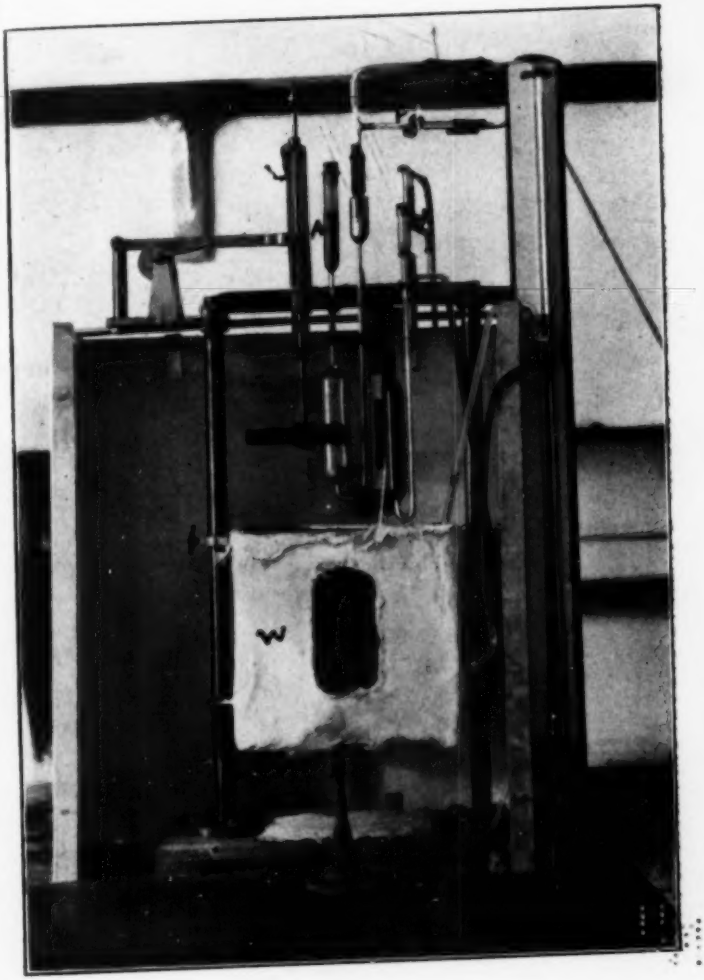
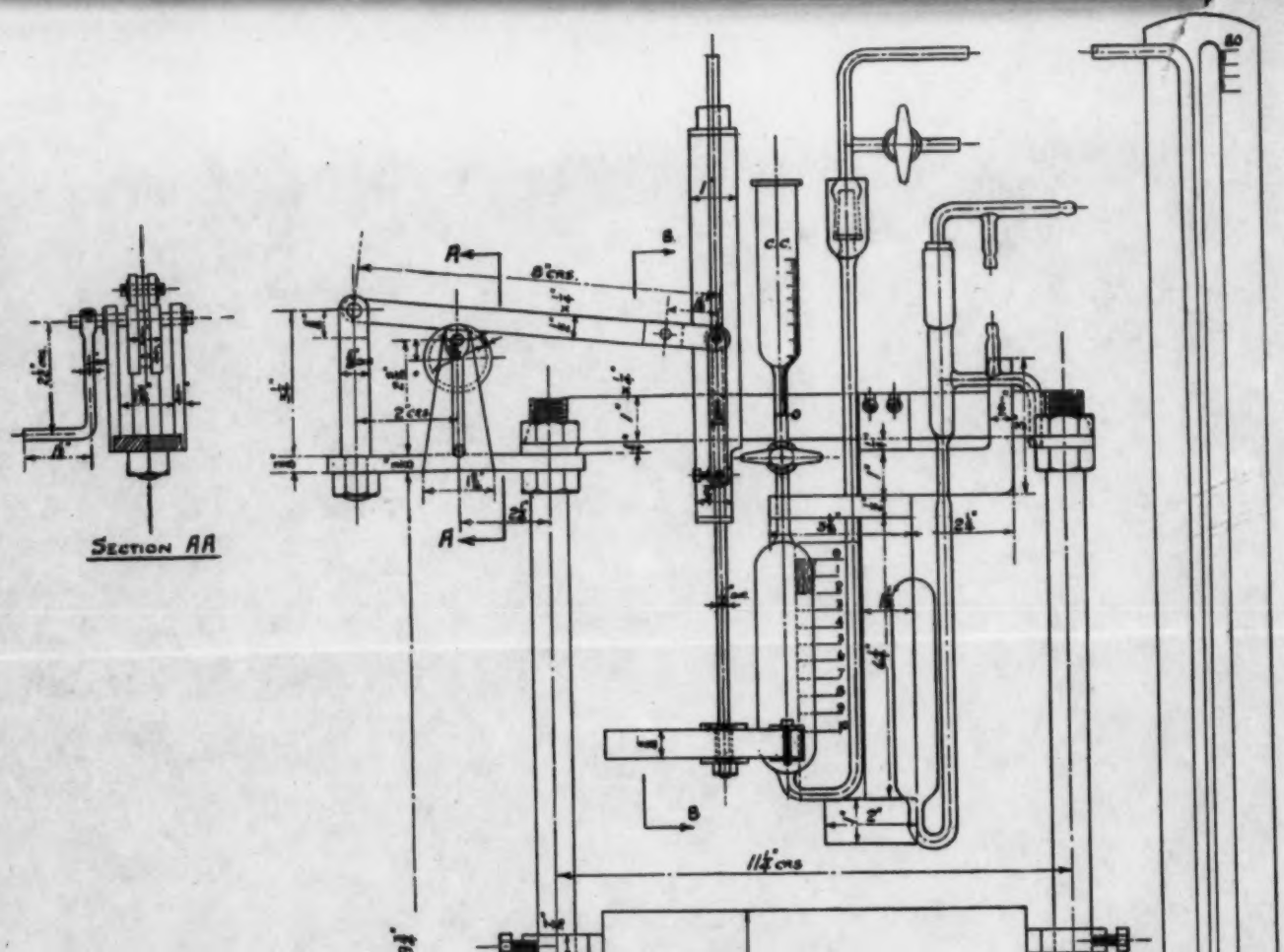
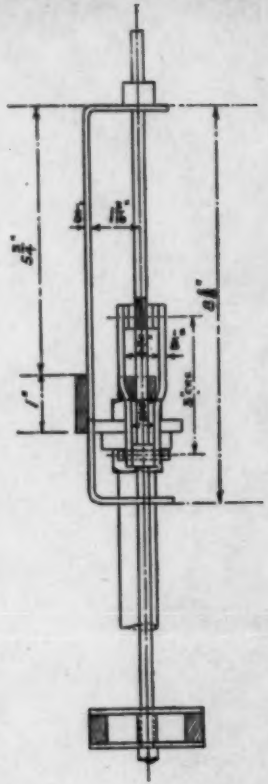


FIG. 1.



SECTION AA



SECTION BB

FIG. 2.

VAPOUR PRESSURE APPARATUS.

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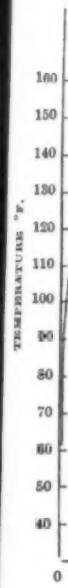

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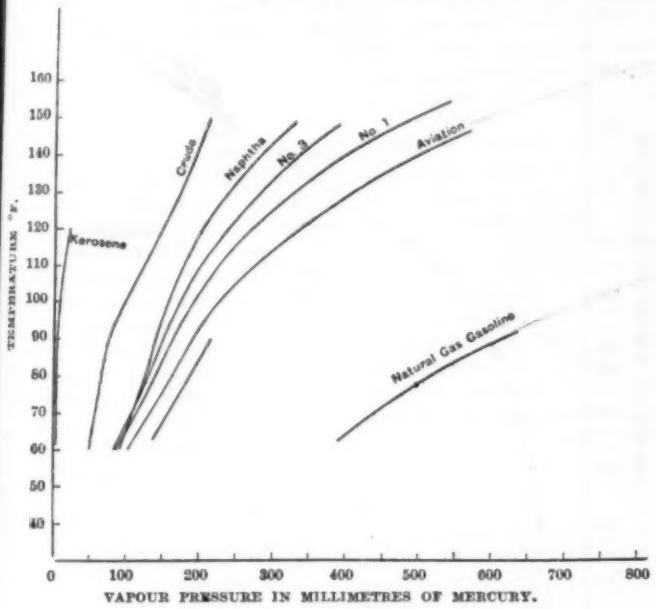
constant while making a measurement by means of a toluol-mercury thermo-regulator. The water in the bath was stirred both by the moving magnet and by a stream of air bubbles.

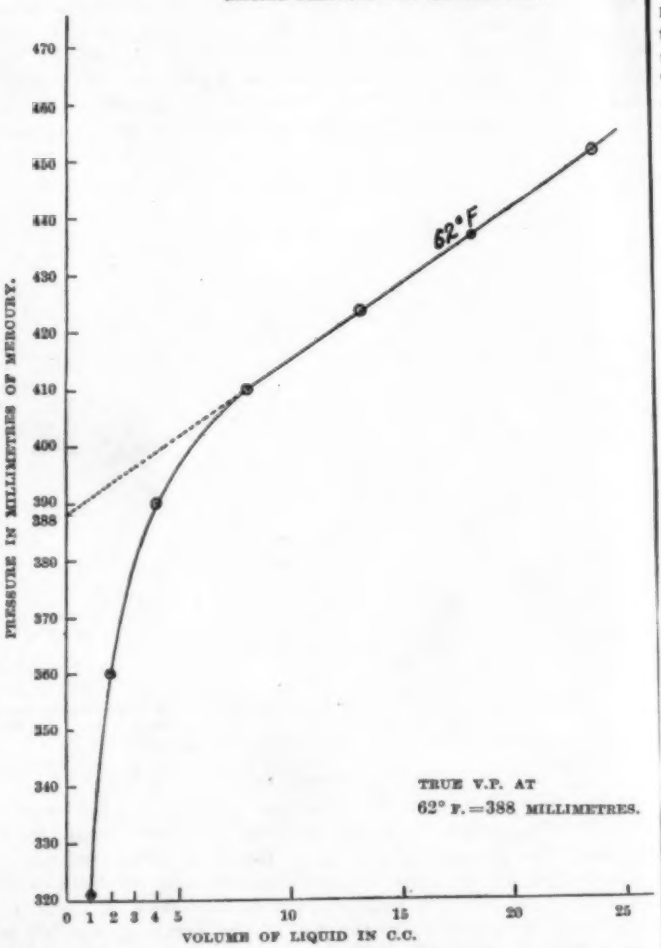
Each vapour-pressure value was obtained from a curve, an example of which is given below, which connects the increase of pressure with the volume of liquid for each sample of the dried material. All effects due to dissolved air or gases, and to the hydrostatic pressure exerted on the mercury in the bulb by the unevaporated liquid, are eliminated by producing the almost straight part of the curve backwards until it cuts the axis of zero volume. This point gives the true vapour pressure required.



Details of manipulation.

At the beginning of a determination warm dry air is drawn through the apparatus by means of a water vacuum-pump, until the interior of the apparatus is quite free from water and water vapour. The air is dried by bubbling through sulphuric acid and is then heated in a large round-bottomed flask or a coil of heated tubing connected to the top of the burette. The air is then withdrawn from the bulb by a pump giving a fairly high vacuum. Initial pressures between 5 and 25 mms. gave con-

cordant results with the same liquid at the same temperature. An average initial pressure of 10 mms. was generally used, obtained conveniently by means of a Fleuss vacuum pump.



About 10 c.c. of dry mercury are now allowed to run into the bulb (B) from the burette (A) care being taken to remove all air-

bubbles by means of a glass capillary tube. The barrel of the tap and the capillary above the tap are kept filled with mercury. The burette is then filled with the liquid to be tested, and all bubbles at the surface of separation removed. The remaining mercury is then allowed to run in till the meniscus coincides with the zero mark on the capillary above the tap (C). Meanwhile, the water bath (W) is brought to the constant temperature required. The level of the mercury is then adjusted by admitting air through the capillary tube (F), till it is the same in the bulb and tube (D). The level in D is then read on the graduated glass scale behind it.

This level is now taken as the zero throughout a determination, the mercury being brought to that point each time before the manometer is read. The levels of the mercury in the manometer and barometer tube are observed and the difference is the initial pressure within the apparatus—*i.e.*, about 10 mms. in the experiments described.

One cubic centimetre of the liquid is run in from the burette and stirred by the magnet until the mercury ceases to rise in the limb (D). When this occurs the mercury level is brought back to the initial zero mark on this limb and the readings taken on the manometer and barometer. From the difference so obtained must be subtracted the initial difference of pressure. This gives the actual pressure due to the vapour from the 1 c.c. of liquid.

The process is then repeated after admitting successively 3, 5, 8, 13 18 and 23 c.c. of the liquid. Care must be taken that the mercury has ceased rising in D before reading the manometer.

A curve is then plotted connecting the observed pressure and the volume of liquid run in; by producing backwards to zero volume the straight portion of the curve the actual vapour pressure is ascertained.

RESULTS.

1. Anglo-Persian Crude Oil. I.B.P. 35° C. (95° F.).

Temperature, ° F.	Vapour pressure in mms. of mercury.
60	47
75	63
90	72
97	88
109	119·5
122	156
149	208

2. Once run Naphtha (0 – 35% on crude). I.B.P. 42° C. (108° F.).

Temperature, ° F.	Vapour pressure in mms. of mercury.
61	87·5
75	117
90	140
118	194
148	328

3. No. 3 petrol. I.B.P. 39° C. (102° F.).

Temperature, ° F.	Vapour pressure in mms. of mercury.
59	79
77	121
90	149
148	380

4. No. 1 petrol. I.B.P. 40° C. (104° F.).

Temperature, ° F.	Vapour pressure in mms. of mercury.
60	85
78	137
90	159
128	314
154	541

5. Aviation spirit. I.B.P. 31° C. (88° F.).

Temperature, ° F.	Vapour pressure in mms. of mercury.
60	99
75	151
90	190
146	518

6. Kerosene. I.B.P. 121° C. (250° F.).

Temperature, ° F.	Vapour pressure in mms. of mercury.
61·5	2
80	3·5
90	4·25
120	19·5

7. Natural-gas gasoline. I.B.P. 30° C. (86° F.).

Temperature, ° F.	Vapour pressure in mms. of mercury.
62	388
78	494
92	633

8. Artificial No. 3 spirit. I.B.P. 35° C. (95° F.).
(Made by blending natural-gas gasoline with a light kerosene cut.)

Temperature, ° F.	Vapour pressure in mms. of mercury.
63	137
75	172
90	218

There is no correlation between the initial boiling points of these hydrocarbon liquids and the temperatures at which their vapour pressures are equal to the atmospheric pressure.

Conclusion.

In most of the standard works on petroleum technology little or no reference is made to vapour pressure. Very few data have been published. The vapour pressure-temperature curves for the products of other oilfields are needed for correlation and would be of considerable interest. From the variations in such curves, made at intervals for the same wells, some light might be thrown on the life of the field. Apart from this, such data are invaluable in studying evaporation losses due to storage-tank breathing, etc., and in the blending of the more volatile spirits with heavier products.

The author wishes to acknowledge with thanks valuable advice and assistance received from Dr. A. E. Dunstan, Dr. F. B. Thole, and the staff of the Anglo-Persian Oil Co.'s research station at Sunbury-on-Thames.

Summary.

1. A method for determining the vapour pressure of crude oil and its products is described. This is a modification of Tizard and Marshall's method. A stirring device is introduced which enables the maximum pressure to be read in much less time.

2. Tables of results obtained from Anglo-Persian crude oil and its products are given and the vapour-pressure-temperature curves plotted between 50° F. and 160° F. A curve is also included to show the effect of blending light and heavy spirits.

3. It is shown that there is no correlation between the initial boiling point (I.B.P.) and the boiling point as ordinarily defined.

4. The vapour-pressure-temperature curve of a mixture of natural-gas gasoline having a high vapour pressure and kerosene having a low vapour pressure shows a great reduction in the vapour pressure of the mixture from that of the gasoline. The value of such data for blending purposes is indicated.

5. An appeal is made for similar data to be published for other oilfields.

Bibliography.

A Method for the Determination of the Vapour Pressure of Hydrocarbon Fuels and the Estimation of Dissolved Air, by H. T. Tizard and A. G. Marshall, *Journal of Institution of Petroleum Technologists*, 8, 31.

Proposed further Study of Methods of Taking Vapour Tension, Dunn, *National Petroleum News*, XVI, No. 33.

Vapour Pressure of Mixed Liquids, Rosanoff, Bacon and White. *Journal of Chemical Society*, 1914, A, ii, 766; Porter, 1921, A, ii, 377.

Condensation Temperatures of Gasoline and Kerosene-Air Mixtures, by R. E. Wilson and D. P. Barnard. *Journal of Industrial and Engineering Chemistry*, Vol. 13, No. 10, 906–912.

Vapour Pressure of Volatile Solvents. R. E. Wilson and E. P. Wylde. *Journal of Industrial and Engineering Chemistry*, August, 1923.

Vapour Pressure Curves for Systems containing Alcohol, Ether and Water. E. A. Louder, T. R. Briggs and A. W. Browne, *Journal of Industrial and Engineering Chemistry*, Vol. 16, No. 9, September, 1924.

Vapour Pressure of Petroleum. J. H. Wiggins. *Petroleum Age*, Vol. 14, No. 4.

Note on the Determination of Lead Tetra Ethyl in Motor Spirit.

By W. R. Ormandy, D.Sc., F.I.C., F.C.S.

In the last number of the Journal a method using strong sulphuric acid for the above determination was described.* The following alternative and somewhat more convenient method in use in this laboratory may be of interest.

When bromine fumes or chlorine are passed into a spirit containing a lead tetra alkyl a bulky white precipitate is produced probably of the type $Pb(CH_3)_3Cl$. This dissolves in dilute hydrochloric acid, but before the lead can be precipitated by the usual reagents it is necessary to boil the acid extract, when complete conversion into lead chloride appears to result. The method is as follows :—

100 c.c. of the spirit are saturated with chlorine by bubbling. The precipitate coagulates and the supernatant liquid becomes bright yellow. Transfer to separating funnel, washing out with dilute hydrochloric acid. Shake out once or twice with further acid and boil the combined extracts for half an hour, preferably under reflux. Add excess of sodium acetate followed by potassium chromate. Keep hot till the lead chromate coagulates and filter in a Gooch crucible.

The results on weighed quantities of lead tetra ethyl are very consistent, but about 7 per cent. low on the laboratory sample. In the case of lead methyl the results are 4 per cent. low. These results seem to confirm the sulphuric acid method, where the results given are about 4 per cent. low. It is probable that these figures indicate the degree of purity of the lead alkyl samples. A determination occupies less than two hours.

The method described has been tried in the presence of carbon tetrachloride and the latter found not to effect the results. Solutions of lead methyl or ethyl on standing in a corked bottle exposed to light deposit a bulky light coloured precipitate.

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* S. F. Birch, *Journ. Inst. Petr. Techn.*, X, 46, 816, Nov., 1924.

REVIEWS.

GASOLINE AND OTHER MOTOR FUELS. Carleton Ellis and Joseph V. Meigs. Constable and Co., London. 1921.

This is a compilation of extreme value for those interested in the subject of motor fuels. The literature of fuels is now so enormous that the hunting of references has become a serious business. A volume like this, which is simply crammed with references in well-arranged sections relating to the various branches of the subject, is a very great help indeed.

It might be objected that many of the processes and plants mentioned in this compilation never existed outside the patent specifications from which they were taken. This criticism, however, has been effectively forestalled by the authors themselves in the preface, where they state that after much thought the conclusion was come to that a complete survey of the art was better than a fragmentary discussion.

One other defect is that the volume is now four years old, but obviously this criticism more nearly touches the Institution than the authors. Progress in relation to motor fuels has been so considerable of recent years that even a cursory reading shows that many developments have taken place since the proofs left the authors' hands. In the section relating to the engine testing of fuels, for example, there is no mention of the work of Midgely and Boyd, or of Ricardo. Hypochlorite refining has assumed technical importance recently and there are developments in analytical methods which are worth inclusion in the next edition.

The work is divided into sections, the authors' scheme being somewhat roughly as follows :—

The general requirements for a motor fuel are first considered, and in this section the question of mixed fuels is dealt with at some length. Throughout the whole book the authors insist on the need for conservation by economical usage of petrol produced from crude petroleum and the desirability of developing alternative sources of supply. Next the chemical and physical testing of gasoline is dealt with and, as mentioned before, this section more than any other needs bringing up to date. From this section also arises very clearly the inadequacy of existing methods of analysis of spirits containing aliphatic unsaturated hydrocarbons. The authors then proceed to the production, distillation and refining of gasoline, leading on to cracking processes by the connecting link—distillation under pressure. In the section on cracking the collected information on the use of aluminium chloride is of very great interest.

The final chapters deal with benzol, alcohol, shale petrol and asphalt distillates. In an appendix is given some very useful and well-arranged statistical information.

The excellence of the whole volume is such as to inspire the hope that an additional volume may be added bringing the work up to date. If, on the other hand, a revised edition be in contemplation, may one suggest with the utmost deference that some means be adopted for obviating the presence of the two folding plates.

E. C. C.

"FUEL." By J. S. S. Brame. Edward Arnold and Co. Pp. 388+xv. Price 18s.

In the first edition of this book Prof. Brame provided a volume which has been not merely the only text-book of its type, but one which was so well written, so thorough in its treatment of the subject and so obviously

the work of an expert, that it has been of the greatest service, not only to fuel specialists, but also to many who, from time to time, need reliable, up-to-date and simply expressed information on some branch of fuel technology.

The third edition now published should be even more successful than the first. The author has overhauled and extended the book with the utmost thoroughness; the information, tables, references and specifications have been brought up-to-date, a large proportion being dated 1924. Sections on the composition and coking properties of coal, the use of powdered coal, the velocity of combustion of gaseous mixtures and the low temperature carbonisation of coal have been revised and the chapters on liquid fuel almost entirely rewritten.

It is not possible in this space to give in detail the scope of the book, which deals with all varieties of solid and gaseous fuels, but the extraordinary thoroughness of the treatment of each section is most striking; one need only mention at random such points as the data on the conditions of flame propagation in petrol-air mixtures, Ricardo's work on mixed fuels, the froth-flotation purification of fine coal, the L.G.O.C. results with alcohol fuel and many summarised reports from the Fuel Research Board, to indicate the up-to-date nature of the information supplied.

Prof. Brame has also adopted that most useful feature of the modern American technical text-book, the inclusion of a number of important current specifications for commercial products such as boiler coal, Diesel fuel oil and power alcohol.

Details of the standard methods recently adopted officially for the testing of coal and petroleum products are also given.

The illustrations are clear and well produced, and over fifty tables are included in the text.

It is not unusual in technical books to find statements on the physics and chemistry of the subject reminiscent of an earlier and occasionally alchemical generation. The chemical qualifications of the author give an effective guarantee of the scientific reliability of this book, but one error has crept in; the author speaks of petroleum jelly as a mixture of paraffin hydrocarbons intermediate in molecular weight between the liquid paraffins and wax, whereas this material consists essentially of non-paraffinoid hydrocarbons of molecular weight much higher than that of wax.

We congratulate Prof. Brame on the production of such an excellent book and his readers on their perspicacity in purchasing it. F. B. T.

"Natural Gas in Alberta." By R. T. Elworthy (Ottawa Canadian Dept. of Mines, Report on Mines Branch, Investigations of Mineral Resources of the Mining Industry).

This brochure is a valuable summary of recent work in Canada on the occurrence and utilisation of natural gas. Canada stands second in the list of world producers, and at the moment accounts for about 20,000,000,000 cub. ft., valued at $5,000,000. Ontario and Alberta are the two prolific provinces in the Dominion. In the former field signs of exhaustion are becoming apparent and steps are being taken to regulate the distribution and use of the gas, the better to conserve this valuable natural product. The situation is different in Alberta, very many large flows having been struck, many potential fields being indicated.

The character of the field work and the method used, the description of the chief ten fields, full analyses, domestic and industrial uses, extraction of gasoline and the manufacture of carbon black are all topics discussed in the report. Of particular interest is the section on the occurrence of helium, which is being compressed in large cylinders at 200 atmospheres pressure in the U.S.A. for aircraft purposes.

At Medicine Hat the helium content averages 0·1 per cent., at Bow Island Well 25. Barn Well yields a gas containing 0·36 per cent., whereas in the United States in Augusta field the percentage of helium rises to 2·04.

From Canadian sources 10/15,000,000 cub. ft. of helium might be produced per annum at a cost of $50 to $100 cub. ft. A. E. D.

American Society for Testing Materials. 1924 Report of Committee D. 2 on Petroleum Products and Lubricants.

The Reports of twenty-one Sub-Committees are dealt with in this valuable brochure.

The consistency of petroleum and lubricating oils and greases are being examined and work is in progress using a penetration method, which is described in an appendix.

Further details in the procedure of viscometry are discussed, but no reference is made to the need for standardising the previous thermal history of the material under test.

Daylight lamps are under investigation for chromometry and the standardisation of the Saybolt colour discs is well under way.

A limit of 0·1 per cent. for the sulphur content of gasoline has been accepted by the Federal Specifications Board, and the lamp method for kerosene has been applied to naphthas, but not to mixtures containing carbon disulphide.

Attempts are being made to complete a table for converting distillation results for difference in barometric pressure. The proposed specification for the A.S.T.M. high-distillation thermometer (range 0-400° C.) are set out in detail.

Efforts are being made to discover a sharper precipitant than the naphtha described in D.91-21T. Holde's "normal benzine" is suggested tentatively.

The oxidation test for lubricating oil, recently accepted by the Bureau of Standards (exposing the oil to oxygen in a closed vessel for 2½ hours at 200° C.), is being considered.

The steam emulsion test is being retained as a tentative standard for another year, and work on the emulsifying properties of oils in alkaline solutions is being actively pursued.

It has been decided to recommend that the present tentative methods of test for flash and fire points should be advanced to standard (D.92-23T.); the Pensky method is to be restricted to fuel oil testing.

An interesting investigation into the A.S.T.M. pour test is described by J. B. Rather and H. M. Anderson, in which a preheating to 115° F. to standardise the previous thermal history is recommended. The possibility of finding a relation between the Iodine number of long-time burning oil and the burning quality (and smoke tendency) is discussed, and the conclusion is drawn that there is no relation between them.

A standard Saybolt test lamp for the burning quality of kerosene is described (D.187-24T.) and a full procedure is given for the test.

The nomenclature sub-committee has defined crude petroleum, topped crude, weathered crude, benzine, gasoline, kerosene, gas oil, fuel oil, pitch, grease, oil-shale, shale and end-point. A. E. D.

CURRENT BIBLIOGRAPHY

Compiled by W. J. Wilson, F.I.C., A.C.G.I.

1. Geological.

Geological Notes on the Oil Regions of Colombia.—M. J. Stephan. *Oil Engineering and Finance* **4**, 493.

Oil Finding in Tunis.—*La Revue Pétrolifère. Oil Engineering and Finance* **4**, 497; **5**, 13.

Faulting Responsible for Mexia Oil Deposit.—W. E. Pratt and F. H. Lahee. *Oil Weekly* **31**, (6), 63.

Migration of Petroleum in Oil Incrustations.—V. Sach. *Petroleum* **19**, 806.

Theory and Science in Oil Finding.—G. M. Edwards. *Oil Engineering and Finance* **5**, 19.

Contributions of Economic Geology, 1922, (2): Mineral Fuels.—*U.S. Geol. Surv. Bull.* 736. *Oil Engineering and Finance* **5**, 22.

The Long Beach Field of California.—A. T. Schwennesen, R. M. Overbeck and W. W. Dubendorf. Amer. Assoc. of Petr. Geologists. *Petr. Times* **11**, 27, 135. *Oil Weekly* **31**, (17), 27.

The Rumanian Oil Fields.—S. L. Mason. *Oil Trade J.* **14**, (11), 64.

Popes Bend Structure Favourable for Oil.—*Oil Weekly* **31**, (10), 49.

Progress Report on a Subsurface Study of the Pershing Oil and Gas Field, Osage County, Oklahoma.—U. W. Rubey. *U.S. Geol. Surv. Bull.* 751-B. *Contributions to Economic Geology* **1923**, (II.), 23.

Oil Migration.—G. W. Bartholomew. *Inland Oil Index* **8** (Nov. 10), 1.

The Geological Structure of the Petroleum Fields of Northern Italy.—M. Gignoux. *Mat. Grasses* **15**, 6494.

Radio-active Sand Bars.—A. J. Sale. *Oil Age* **20** (Sept.), 27; (Oct.), 29.

Similar, Parallel and Neutral Surface Types of Folding.—E. L. Ickes. *Econ. Geol.* **18**, 575.

Survey to Report on Oil Chances in Northwest Colorado.—*Nat. Petr. News* **15**, (41), 83.

The Teapot Oil Affair.—C. W. Washburne. *Min. and Met.* (186), 7.

Work of Geologists is Most Important.—K. C. Heald. *Oil and Gas J.* **22**, (19), 58.

Geologic Reconnaissance by Hydroplane.—F. O. Martin. *Union Oil Co. of California Bull.* 32, 15.

Says Geologists' Associations is Stabilising Influence.—*Nat. Petr. News* **15**, (40), 85.

2. Geographical.

The Future of Argentine.—*Oil Engineering and Finance* **4**, 501.

Fuel Resources and Supplies.—Admiral Sir Edmond J. W. Slade. *Oil Engineering and Finance* **4**, 502. *Petr. Times* **10**, 859.

Treatment of Canadian Tar Sands.—*U.S. Commerce Rept. Oil Engineering and Finance* **4**, 504.

Oil Developments in Poland.—*Polish Economic Bull. Oil Engineering and Finance* **4**, 504.

Russian Oil Output.—*Oil Engineering and Finance* **4**, 504.

Petroleum in Italy.—*U.S. Commerce Rept. Oil Engineering and Finance* **4**, 504.

Oil Resources of the Pacific Region: Geology Section of the Pan-Pacific Congress Discussion.—*Petr. World.* **20**, 494.

Oil Industry of Japan.—G. B. Green. *Petr. Age. Petr. World* **20**, 501.

World's Oil Production in 1922.—*Petr. World* **20**, 505.

The World's Petroleum Output.—*Petr. Times* **10**, 778.

The Petroleum Prospects of Sakhalin Island.—C. W. Purington. *Min. and Met.* **4**, 453. *Petr. Times* **10**, 810.

Commercial Products from the Athabaska Tar Sands.—*U.S. Commerce Repts.* (Oct. 16).

Consumption of Fuel Oil in Belgium.—*U.S. Commerce Repts.* 169.

Mystery Surrounds Work in Peruvian Fields.—A. E. Fowkes. *Oil Weekly* **31**, (6), 31.

Petroleum and Natural Gas.—D. T. Day. *Mineral Ind.* **31**, 499.

Petroleum in the Philippines.—*Petr. Times* **10**, 328. *Chem. Abstr.* **17**, 3781.

Researches on Italian Petroleums.—M. Fenoglio. *Ann. chim. applicata* **13**, 80. *Chem. Abstr.* **17**, 3781.

Petroleum Production in France.—*The Lamp. Petr. World* **21**, 17.

Dutch East Indian Petroleum.—*Petr. World* **21**, 19.

Our Oil and Petrol Consumption and Supplies.—*Petr. World* **21**, 20.

Petroleum Provinces of the United States.—E. R. Lilley. *Petr. World* **21**, 34.

Oil Prospecting and the Argentine Mining Law.—L. Sol. *Oil Engineering and Finance* **5**, 11.

Petroleum in Algeria.—*Mat. Grasses* **16** (Dec. 15). *Oil Engineering and Finance* **5**, 24.

Petroleum in Madagascar.—*Mat. Grasses* **16** (Dec. 15). *Oil Engineering and Finance* **5**, 37.

Esthonian Oil Imports.—*U.S. Commerce Repts. Oil Engineering and Finance* **5**, 38.

THE PETROLEUM SEARCH IN FRANCE.—*Petr. Times* **10**, 909.

PERU'S RESERVES OF OIL.—O. V. Salomon.—*Petr. Times* **10**, 914.

REFINING OF RUMANIAN CRUDE OIL ANALYSED.—*Oil Trade J.* **14**, (11), 68.

CANADA: CRUDE PETROLEUM IN 1922.—*Chem. and Ind.* **42**, 1216.

DIE WELTINTERESSEN DER ENGLISCHEN PETROLEUM-INDUSTRIE.—S. Jessen. Finanzverlag G.m.b.H., Berlin.

OIL DRILLING PROSPECTS IN SPAIN.—*Oil News* **15**, 46.

OIL DEVELOPMENT IN ALBERTA.—G. S. Hume. *Oil News* **15**, 50.

THE OIL SITUATION AND PROSPECTS IN CANADA.—G. S. Hume. *Petr. Times* **11**, 66. *Oil News* **14**, 644. *Chem. Trade J.* **73**, 769.

1923: COMPLETE OIL IMPORTS AND EXPORTS.—*Oil News* **15**, 66.

OUR GROWING PETROLEUM IMPORT TRADE.—*Petr. Times* **11**, 77.

THE MUD VOLCANOES IN THE RUMANIAN OIL ZONE.—*Petr. Times* **11**, 92.

NEW DEEP SANDS IN POWELL FIELD PROBABLE.—*Oil Weekly* **31**, (10), 13.

THE RUMANIAN PETROLEUM INDUSTRY.—*Petr. Times* **11**, 113.

ECONOMIC FINANCIAL CONDITIONS IN MEXICO.—N. King. H.M. Stationery Office. *Petr. Times* **11**, 120.

PRELIMINARY REPORT ON THE EASTERN PART OF THE SMACKOVER, ARKANSAS, OIL AND GAS FIELD.—H. W. Bell, P. S. Haury and R. B. Kelly. Arkansas State Bureau of Mines, Manufactures, and Agriculture, in co-operation with U.S. Bureau of Mines.

GAS AND PETROLEUM IN WESTERN CANADA.—*Canadian Mining J.* **44**, 283.

AREAS IN CHINA CONSIDERED AS POTENTIAL OIL BEARING TERRITORY.—T. O. Chu. *Nat. Petr. News* **15**, (43), 77.

HISTORY OF THE MID-CONTINENT OIL FIELD.—T. M. Galey. *Oil and Gas J.* **22**, (21), 56.

THE RECENT SEARCH FOR PETROLEUM IN GREAT BRITAIN.—H. P. W. Giffard. *Nat. Petr. News* **15**, (37), 75; (38), 83.

THE ARGENTINE PETROLEUM OIL FIELDS.—C. M. Hunter. *Chim. et Ind.* **9** (Special No.), 118.

PURISIMA-SAN GREGORIO OIL FIELDS, SAN MATEO, CALIFORNIA.—H. H. McClintock. *Oil Age* **20** (Nov.), 38.

EARLY OIL DEVELOPMENT IN CALIFORNIA.—W. W. Orcutt. *Union Oil Co. of California Bull.* 32, 3.

OCCURRENCE OF PETROLEUM IN GEORGIA.—*Petroleum* **19**, 723.

THE PRODUCTION RECORD OF LONG BEACH FIELD.—F. J. Shayer. *Oil Weekly* **30**, (1), 23.

PETROLEUM INDUSTRY OF ITALY.—*U.S. Commerce Repts.* (Nov. 5), 349.

UNKNOWN WORTH OF ACREAGE AND DRILLING REQUIREMENTS HELD BACK SALE.—P. Wagner. *Nat. Petr. News* **15**, (43), 55.

THE OIL FIELDS OF THE RAWLINS-LOST SOLDIER DISTRICT, WYOMING.—E. W. Krampert. *Inland Oil Index* **8** (Nov. 3), 9.

OIL POSSIBILITIES IN FLORIDA BEING TESTED BY DRILLERS.—*Oil and Gas J.* **22**, (23), 114.

MILLER COUNTY ARK. WILL GET PLAY.—R. H. Whitney. *Oil and Gas J.* **22**, (21), 122.

THE CHEMICAL PROPERTIES AND GENERAL CHARACTERISTICS OF CALIFORNIA PETROLEUMS.—P. W. Prutzman. *Petr. World (Los Angelos)* **8** (Oct.), 32. *Petr. Times* **11**, 51.

MINING REGULATIONS IN RUSSIA RECENTLY ADOPTED AND PROMULGATED.—*Salt Lake Mining Review* **25** (Oct. 30), 13. *Oil and Gas J.* **22**, (23), 109.

CANADA'S OIL REFINERIES.—*Canadian Mining J.* **44**, 477.

PRESENT CONDITIONS IN BAKU OIL FIELD DECLARED FAVOURABLE.—*Oil and Gas J.* **22**, (23), 118.

PETROLEUM PRODUCTS TRADE OF JAPAN FOR 1922.—*U.S. Commerce Repts.* (Aug. 20), 482.

CRUDE PETROLEUM PRODUCTION.—*U.S. Commerce Repts.* (June 18), 754.

PRODUCTION OF STATE WELLS IN CZECHOSLOVAKIA.—*U.S. Commerce Repts.* (May 7), 384.

PRESENT STATUS OF MEXICAN OIL INDUSTRY.—*U.S. Commerce Repts.* (Oct. 1), 15.

MEYER ZONE CONTOUR MAP, SANTA FE SPRINGS.—*Mining and Oil Bull. Suppl.* **9** (Oct.).

REPORT ON SANTA FE SPRINGS OIL FIELD.—J. B. Case. *Monthly Chapter Eighth Annual Report, State Oil and Gas Supervisor, California State Mining Bureau* **8** (May), 5.

SANTE FE SPRINGS FIELD, CALIFORNIA.—R. R. Templeton and C. R. McCollom. *Min. and Oil Bull.* **9**, 869.

RECENT EXPLORATION FOR PETROLEUM IN THE UNITED KINGDOM.—E. L. Ickes. *Min. and Met.* **4**, 528.

GUATEMALA IS HOPEFUL OF DEVELOPMENT OF IMPORTANT OIL FIELDS.—F. S. Latour. *Nat. Petr. News* **15**, (41), 32F.

THREE-YEAR $1,000,000 CAMPAIGN NEAR ARCTIC CIRCLE ABANDONED.—V. Lauriston. *Oil and Gas. J.* **22**, (18), 79.

OIL AT WHEELER-RIDGE, CALIFORNIA.—*Mining and Oil Bull.* **9**, 859.

INDIAN FIELDS TO BE FACTOR FOR YEARS TO COME.—*Nat. Petr. News* **15**, (41), 86.

GALICIAN PETROLEUM.—G. Nicloux. *Chim. et Ind.* **9**, (Special No.), 97.

JAPAN'S PRODUCTION AND OIL CONSUMPTION TOLD BY A JAPANESE.—*Oil and Gas J.* **22**, (18), 117.

To Find Out what Madagascar has to Offer.—*Oil Weekly* **31** (16), 13.

History of Long Beach Development.—*Oildom* **14** (Aug.), 13.

Petroleum Possibilities in Venezuela, Exploration and Actual Development.—J. F. Sheridan. *Oil Paint and Drug Reporter* **104** (16), 20.

Is there Oil in Alberta? Answer Seems as Remote as Ever.—L. Smith. *Nat. Petr. News* **15**, (32), 51.

Optical Behaviour and other Properties of Egyptian Petroleum.—M. A. Rakusin. *Petroleum* **19**, 412.

Refining and Analyses of Special Galician Petroleum.—L. Rosner. *Petroleum* **19**, 291.

Peru's Oil Development has been Rapid; its Future is Bright.—S. G. Bedoya. *Nat. Petr. News* **15**, (41), 32G.

Influence of Rocky Mountain Fields.—C. E. Bowles.—*Oil and Gas J.* **22**, (16), 22.

Production and Refining in California.—C. E. Bowles. *Oil and Gas J.* **22**, (15), 18.

7,000,000,000 Barrels of Crude Oil.—J. McIntyre. *Oil and Gas J.* **22**, (19), R-8.

Sante Fe Springs, Calif., decline Curves.—*Oil and Gas J.* **22**, (19), 150.

Royal Dutch Oil Output in East Indies gained in 1922.—*Oil Paint and Drug Reporter* **104** (Aug. 13), 47.

Menace of Mexico may Demand Tariff.—C. E. Kern. *Oil and Gas J.* **22**, (19), 152.

Teapot Dome falls far below Estimates made Before Drilling Began.—L. E. Smith. *Nat. Petr. News* **15**, (35), 21.

3. Drilling and Field Operations.

Fire Prevention in Oil Wells.—G. Triplett. *Oil Weekly* **30**, (17). *Oil Engineering and Finance* **4**, 502.

Costs of Transference of Oil from Well to Tank.—U.S. Bureau Mines. *Petr. World* **20**, 519.

Migration of Sand a Factor in Production.—W. Pennington. *Oil Weekly* **31**, (5), 13.

What does it Cost to Lift your Oil?—W. C. George. *Oil Weekly* **31**, (5), 19.

Automatic Spider Saves Time Making Round Trips.—*Oil Weekly* **31**, (5), 65.

The Human Element of Fire Prevention.—G. Triplett. *Oil Weekly* **31**, (6), 19.

BACK PRESSURE EFFECTIVE FOR WELL CONTROL.—J. M. Lovejoy. *Oil Weekly* **31**, (6), 27.

OIL FINDING UP-TO-DATE.—Sullivan Machinery Co., Chicago.

DIAMOND DRILLING FOR OIL.—Sullivan Machinery Co., Chicago.

RECOMMENDATIONS FOR STANDARDISED RIG IRONS.—O. V. Borden. *Oil Weekly* **31**, (7), 11.

HOW TWO STUBBORN FIRES WERE CONQUERED.—G. Triplett. *Oil Weekly* **31**, (7), 19.

CONTROLLING THE WILDCAT TO REGULATE OUTPUT.—H. W. Bell. *Oil Weekly* **31**, (7), 25.

INTERNAL-COMBUSTION ENGINES FOR OIL WELL DRILLING.—*Petr. Times* **10**, 845.

STANDARDISATION OF ROTARY EQUIPMENT.—J. F. Lucey. *Petr. Times* **10**, 878.

ABBAU UND AUFBEREITUNG VÖN OLSANDEN.—G. Schneider. *Petroleum* (Nov. 1). *Petr. Times* **10**, 898.

"VOLOMITE," A SUBSTITUTE FOR DIAMONDS IN BORING.—A. G. Himmelfarb. *Gory Zhurnal* (Aug.-Sept.), 446. *Oil Engineering and Finance* **5**, 18.

HOW MANY ACRES TO A WELL?—*Petr. Age* **12**, (10), 48.

MANUAL FOR OIL AND GAS OPERATION.—T. E. Swigart and C. E. Beecher. *U.S. Bureau of Mines Bull.* 232.

REVOLUTION IN DEEP DRILLING PRACTICE.—Petr. Management (Baku). A. P. Serebrovsky. *Oil News* **15**, 41.

MAGNETIC BOREHOLES.—*Nature. Oil News* **15**, 47.

DRILLING WELLS WITH A DIAMOND CORE DRILL.—F. R. Rees. *Oil Trade J.* **14**, (12), 70.

STEEL DERRICK UNINJURED BY TERRIFIC BLOW-OUT.—*Oil Trade J.* **14**, (12), 78.

NEW RELEASE SPEAR EVOKES FAVOURABLE COMMENT.—*Oil Trade J.* **14**, (12), 78.

PREVENTING OIL FIELD FIRES—HOW AND WHY.—G. Triplett. *Oil Weekly* **31**, (2), 35.

PUMPING UNIT OFFERED BY ROCK ISLAND PLOW CO.—*Oil Weekly* **31**, (2), 87.

NEW ENGINE WELL ADAPTED FOR OIL FIELD PUMPING.—*Oil Weekly* **31**, (2), 87.

STANDARDISING ROTARY DRILLING EQUIPMENT.—J. E. Lucey. *Oil Weekly* **31**, (9), 13.

MUD MADE QUICK WORK OF CALIFORNIA FIRE.—G. Triplett. *Oil Weekly* **31**, (9), 19.

CORE DRILLING IN CALIFORNIA.—J. E. Elliott. *Oil Weekly* **31**, (9), 23.

MCCORMICK-DEERING TRACTOR AND BAY CITY WINCHIS LATEST OIL FIELD COMBINATION.—*Oil Weekly* **31**, (9), 65.

New Combination Set Shoe and Back Pressure Valve.—*Oil Weekly* **31**, (10), 67.

Oil Well Drilling Methods.—V. Ziegler. J. Wiley and Sons, Inc., New York, and Chapman and Hall, London.

Russian Drilling Methods.—V. C. Sviminoff. *Rig and Reel Magazine* **5** (Oct.), 4.

Gas Engines and the Pumping Problem.—J. M. Davis. *Bessemer Monthly* (212), 3.

Wide Variation shown in Lifting Costs in Fields of United States.—H. C. George. *Nat. Petr. News* **15**, (43), 67.

Recovering Oil by Perforating the Water String.—H. A. Godde. *Monthly Chapter, Ninth Annual Report, State Oil and Gas Supervisor, California State Mining Bureau* (July), 5.

Electrical Deep Pumping Equipment.—W. G. Lane. *Oil Age* **20** (Nov.), 47.

Oil Engineer Devises Pressure Gauge.—*Nat. Petr. News* **15**, (43), 62.

The Panorama of Petroleum—Drilling the Well.—*Oil News* (*U.S.A.*) **11** (Nov.), 13.

Winning a 9-Day Battle against Fire.—G. Triplett. *Rig and Reel Magazine* **5** (Nov.), 4.

Notes on Use of Resin for excluding Water from Oil Wells.—R. M. Barnes. *Monthly Chapter, Eighth Annual Report, State Oil and Gas Supervisor, California State Mining Bureau* (June), 5. *Oil Weekly* **31**, (10), 25. *Petr. Age* **12**, (10), 44.

Lands Longest String of 8-Inch Pipe on Record.—*California Oil World* **15** (Aug. 30), 2.

Should Keep Closer Check on Wildcat Logs.—H. D. Easton. *Oil Weekly* **30**, (3), 25.

Technique of Core Drilling.—J. E. Elliott. *Min. and Met.* **4**, 515.

Meeting Production Problems in California.—J. Jensen and G. D. Robertson. *Oil Weekly* **31**, (15), 21; (16), 27.

Lease Equipment Wrinkles.—*Nat. Petr. News* **15**, (41), 45.

New Control Head for Extinguishing Fires.—*Oil Weekly* **31**, (17), 65.

Pump Ontario Wells with Hydro-Electricity.—*Oil Weekly* **31**, (16), 25.

Drilling Superintendent Cuts Drilling Cost by Utilising Gas Flow for Fuel.—*Oil Weekly* **31**, (16), 23.

Mud Pumps Play Big Part in Making Hole.—H. Pennington. *Oil Weekly* **31**, (16), 12.

Increasing Oil Well Production in the Kern River Field.—G. O. Suman. *Eng. and Min. J. Press* (*Pac. Min. News*) **2**, 299.

Preventing Fires on Producing Oil Wells.—G. Triplett. *Oil Weekly* **31**, (17), 19.

KEEPING GAS AND ELECTRICITY SEPARATED.—G. Triplett. *Oil Weekly* **31**, (16), 19.

PUTTING OUT THE FIRE ON A BAD ONE AT HULL.—G. Triplett. *Oil Weekly* **30**, (12), 19.

PROSPECTING WITH THE EÖTVÖS BALANCE.—E. Wagner. *Eng. and Min. J. Press* **116**, 583.

HOW OIL WORKERS ARE INJURED WHILE REPAIRING ROTARY DRILLING ENGINES.—J. W. Gebb. *California Safety News* **7** (Sept.), 3.

EIGHTY PER CENT. OF OIL NOT RECOVERED.—K. C. Heald. *Oil and Gas J.* **22**, (21), 58.

REPORT OF PROPOSED A.P.I. PIPE STANDARDS.—*Oil and Gas J.* **22**, (22), 34.

PATENTS.

PIPE SYSTEM FOR SAVING GAS AND OIL FROM PRODUCING WELLS.—E. A. Starke. U.S. Pat. 1,467,512.

FISHING APPARATUS FOR WELLS.—A. H. Brandon, Assr. to Deep Well Engin. Co. U.S. Pat. 1,473,606. *Petr. Age* **12**, (12), 72.

OIL SAVING DEVICE FOR OIL WELLS.—O. B. Anderson. U.S. Pat. 1,472,952.

SELF-LUBRICATING PITMAN ROD.—J. M. Axtell. U.S. Pat. 1,471,818.

DRILL BIT.—S. F. Bashara. U.S. Pat. 1,465,407.

PUMPING POWER FOR WELLS.—E. C. Bennett. U.S. Pat. 1,467,773.

RELEASING DEVICE FOR WELL TOOLS.—C. E. Brown. U.S. Pat. 1,471,775.

FISHING TOOL.—C. H. Brown. U.S. Pat. 1,469,493.

BALL-BEARING SWIVEL SUCKER-ROD JOINT.—R. E. Cox. U.S. Pat. 1,471,105.

GAS DIAPHRAGM.—C. P. Dubbs. U.S. Pat. 1,470,352.

FISHING TOOL, SUCKER ROD OVERSHOT.—S. A. Erwin. U.S. Pat. 1,470,114.

HAMMER AND ROTARY DRILL COMBINED.—R. Z. Farmer. U.S. Pat. 1,468,345.

DOUBLE-ACTING OIL AND WATER PUMP.—N. Fellabaum. U.S. Pat. 1,468,199.

CALKING MACHINE FOR PIPE JOINTS.—W. H. Flint. U.S. Pat. 1,469,297.

DEEP-WELL PUMP.—G. L. Fuller. U.S. Pat. 1,467,370.

OIL-WELL DRILLING EQUIPMENT.—A. T. Hagaman. U.S. Pat. 1,467,635.

WELL TOOL.—J. W. Hooser. U.S. Pat. 1,471,607.

OPERATING OIL WELLS.—F. A. Howard. U.S. Pat. 1,473,348.

ROTARY JAR.—J. A. Kammerdiner. U.S. Pat. 1,469,305.

REAMER AND POLISHER COMBINED.—R. C. McClay. U.S. Pat. 1,467,977.

OIL PUMP.—B. W. Macy. U.S. Pat. 1,467,411.

FLOATING REAMER.—A. A. Martell. U.S. Pat. 1,470,020.

MULTIPLE FISHING TOOL.—H. M. Myracle. U.S. Pat. 1,473,158.

DRILL.—R. E. Overman. U.S. Pat. 1,468,509.

FISHING TOOL.—F. J. Pearl. U.S. Pat. 1,466,916.

WORKING VALVE FOR OIL-WELL PUMPS.—C. Phillips. U.S. Pat. 1,469,106.

REAMER.—A. T. Rossignol. U.S. Pat. 1,470,545.

APPARATUS FOR TREATING FRESH PETROLEUM.—H. P. Porter. U.S. Pat. 1,471,705. *Petr. Age* **12**, (10), 62.

UNDERREAMER.—J. D. Russ. U.S. Pat. 1,471,808.

RIVET CATCHER FOR OIL-WELL PUMPS.—P. T. Spruill. U.S. Pat. 1,465,320.

APPARATUS FOR EJECTING FLUIDS FROM WELLS.—R. H. Tucker. U.S. Pat. 1,471,758.

SHOCK-ABSORBING ATTACHMENT FOR WELL CASINGS.—R. E. Fair. U.S. Pat. 1,465,120.

OIL TUBE CLEANER.—W. J. Gerber. U.S. Pat. 1,464,069.

UNDERREAMER.—C. L. Giebell. U.S. Pat. 1,463,316.

WELL ELEVATOR.—H. M. Harris. U.S. Pat. 1,460,652.

PROCESS AND APPARATUS FOR EXTRACTING HYDROCARBONS FROM OIL WELLS AND OIL-BEARING STRATA.—W. J. Knox. U.S. Pat. 1,462,288.

OIL INDICATOR AND PUMP PRIMER.—G. F. Madden. U.S. Pat. 1,459,681.

ARRANGEMENT OF OIL PUMPS.—E. L. Müller. U.S. Pat. 1,460,431.

ELECTRIC HEATER FOR OIL WELLS AND THE LIKE.—P. S. Porshing. U.S. 1,464,618.

OIL-WELL SWAB.—L. E. Robinson. U.S. Pat. 1,459,151.

IRON SPOOL FOR WIRE CABLE OF OIL WELLS.—E. F. Smith. U.S. Pat. 1,462,388.

WELL-PIPE SCREEN.—S. H. St. John. U.S. Pat. 1,460,735.

REAMER.—F. W. Straehle. U.S. Pat. 1,465,029.

DRILL.—F. W. Zimmerman. U.S. Pat. 1,461,791.

4. PIPE-LINES, TRANSPORT AND STORAGE.

BULK STORAGE OF PETROL FOR PRIVATE USERS.—A. Hayes. *Oil Engineering and Finance* **4**, 531; **5**, 48.

ALUMINIUM PAINT FOR OUTSIDE WORK.—J. D. Edwards. *Chem. and Met. Eng.* **29**, 927.

HOW ELECTRIC MOTORS SHOULD BE APPLIED TO PUMPING EQUIPMENT.—R. H. Rogers. *Chem. and Met. Eng.* **29**, 928.

FLOATING ROOFS FOR OIL TANKS.—*Petr. Times* **10**, 770.

TANKS ARE TARGETS FOR LIGHTNING BOLTS.—G. Triplett. *U.S. Bureau Mines Repts. Investigations. Oil Weekly* **31**, (5), 23.

SAFETY ROOF FOR TANKS IS COLUMBIAN PRODUCT.—*Oil Weekly* **31**, (6), 73.

EVAPORATION LOSSES CUT CONSIDERABLY IS CLAIM OF WIGGINS FLOATING ROOF.—*Oil Weekly* **31**, (7), 25.

HOW COLOUR REDUCES THE EVAPORATION OF OIL.—W. T. Deacon. *Oil News* (*U.S.A.*) **11**, (17), 13. *Chem. Abstr.* **17**, 3783.

CONCRETE TANK CONSTRUCTION AND ITS USE FOR THE STORAGE OF PETROLEUM.—L. Waterhouse. *Oil Engineering and Finance* **5**, 15.

GASOLINE TANKS PROTECTED BY ARTIFICIAL SHADE.—*Oil Trade J.* **14**, (11), 76.

A NEW FOE TO EVAPORATION.—*Petr. Age* **12**, (10), 68.

TANKER CHARTERING REVIEW.—*Oil News* **15**, 41. *Petr. Times* **11**, 48.

CENTRIFUGAL PUMPS ADAPTED TO PIPE-LINE USE.—W. L. Beadle. *Oil Weekly* **31**, (10), 21.

MAKING EVAPORATION AN ALLY.—C. P. Buck. *Petr. Age* **13**, (1), 18.

GAS-TIGHT TANKS.—J. H. Wiggins. *U.S. Bureau of Mines Tech. Paper* 319. *Petr. Age* **13**, (1), 70. *Chem. and Met. Eng.* **30**, 55.

STORAGE OF SURPLUS CALIFORNIA OIL.—*Atlantic Seal* **1**, (Oct.), 4.

ECONOMICAL TRANSPORTATION ON NEW YORK STATE CANAL.—G. P. Gleason. *Motorship* **8**, 173.

WIGGINS FLOATING ROOF WITHSTANDS FIRE TESTS.—*Oil Age* **20**, (Nov.), 41.

A STURDY PRESSURE GAUGE.—*The Record* (Pacific Associated and Amalgamated Oil Cos.) **4**, (Oct.), 8.

WORLD'S LARGEST STEEL TANKS FOR OIL STORAGE.—L. D. Jurs. *Min. and Oil Bull.* **9**, 856.

NEW METHOD IN TANK CONSTRUCTION.—*Mining and Oil Bull.* **9**, 873.

HOW OIL STORAGE IS BUILT.—*Mining and Oil Bull.* **9**, 850.

INVITE CRITICISMS ON PROPOSED CODE OF TOLERANCES FOR TANKS.—*Nat. Petr. News* **15**, (41), 51.

EFFECT OF COOLING SYSTEMS ON EVAPORATION LOSSES OF GASOLINE.—L. Schmidt. *Nat. Petr. News* **15**, (42), 51.

TRANSPORTATION COSTS OF REFINED OILS.—N. O. Fanning. *Oil and Gas J.* **22**, (10), 19.

SOLVING PROBLEM OF STORING OIL SURPLUS.—C. E. Kern. *Oil and Gas J.* **22**, (15), 48.

PATENTS.

OUTLET VALVE FOR TANK CARS.—E. L. Chatfield. U.S. Pat. 1,472,293.

LOW-GASOLINE SIGNAL.—C. W. Dixon. U.S. Pat. 1,465,351.

AUTOMATIC WATER DRAIN FOR OIL TANKS.—J. A. Jolly. U.S. Pat. 1,471,737.

DEVICE FOR DRAIN WATER FROM OIL TANKS.—W. J. McArthur. U.S. Pat. Re. 15,678.

CONTROLLING VALVE FOR HYDRAULIC OIL STORAGE AND DISTRIBUTION SYSTEMS.—F. G. Farr. U.S. Pat. 1,470,233.

5. REFINERY TECHNIQUE.

EINFACHE UND FRAKTIONIERTE DESTILLATION IN THEORIE UND PRAXIS.—C. V. Rechenberg. Schimmel and Co., Leipzig.

DECOLORISING MINERAL OILS.—D. T. Day. *Oil Engineering and Finance* **4**, 505.

CENTRIFUGAL VS. GRAVITATIONAL FORCE.—E. E. Ayres. Amer. Inst. of Min. and Metallurgical Engrs. *Chem. and Met. Eng.* **29**, 931.

SLUDGE ACID CONCENTRATION.—*Acid Recovery Division, United Lead Co. Bull.* 2.

USE OF LIME IN PETROLEUM REFINING.—B. T. Brooks. *Rock Products* **27**, (18), 35. *Chem. Abstr.* **17**, 3783.

THE HYPOCHLORITE PROCESS OF OIL REFINING.—Mathieson Alkali Works, Inc., New York City. *Petr. World* **21**, 36.

THE PURIFICATION OF MINERAL OILS WITH LIQUID SULPHUR DIOXIDE.—L. Edeleanu. *Z. angew. Chem.* **36**, 573. *Petroleum* **19**, 1195. *Petr. Times* **10**, 916. *J. Soc. Chem. Ind.* **43**, B44.

EXPULSION OF ADSORBED SUBSTANCES FROM BODIES OF LARGE SURFACE AREA.—E. Berl and W. Schwebel. *Z. angew. Chem.* **36**, 541, 552. *J. Soc. Chem. Ind.* **42**, 1210A.

MAKING THE REFINERY DRAW A PROFIT BY REDUCING OPERATING COSTS. RECLAIMING STILL GASES.—P. Truesdale. *Nat. Petr. News* **15**, (48), 23.

CENTRIFUGING REMOVAL OF WAX FROM ALL LUBRICATING STOCKS.—L. D. Jones. *Trans. Am. Inst. Mining Met. Eng.* (1275). *Oil and Gas J.* **22**, (20), 92. *Nat. Petr. News* **15**, (41), 32A. *Chem. Abstr.* **17**, 3916. *J. Soc. Chem. Ind.* **43**, 7B.

THE PURIFICATION AND PRODUCTION OF PETROLEUM PRODUCTS WITH SILICA GEL.—F. Meyer. *Brennstoff Chem.* **4**, 358.

REDUCING OPERATING LOSSES IN PETROLEUM REFINING.—P. Truesdell. *Nat. Petr. News* **15**, (50), 35.

DEHYDRATION OF OIL BY AN ELECTRICAL PROCESS.—F. D. Mahone. Am. Inst. of Petr. Tech. *Petr. Times* **10**, 920.

OIL REFINING METHODS REVIEWED.—W. A. P. Schormann. *Canad. Chem. and Met.* **7**, 315.

PETROLEUM REFINING CENSUS OF MANUFACTURES, 1921.—U.S. Bureau of the Census.

NATURAL GASOLINE IN A STRAIGHT RUN REFINERY.—*Oil Trade J.* **14**, (12), 98.

BLENDING NATURAL GASOLINE.—H. R. Noble. *Petr. Age* **13**, (1), 52.

THE ACID AND FULLER'S EARTH TREATMENT OF CALIFORNIA CRACKED DISTILLATES.—G. Egloff and J. C. Morrell. *Oil Age* **20**, (Nov.), 27.

THE IDEAL DISTILLATION PROCESS.—E. H. Leslie. *Oil News* (*U.S.A.*) **11**, (Nov.), 15.

PURIFICATION OF LIQUIDS BY THE SIMULTANEOUS ACTION OF CENTRIFUGAL FORCE AND AN ELECTRICAL FIELD.—A. Marx and J. Rozieres. *Chim. et Ind.* **10**, 218.

THE USE OF LIME IN GREASE MAKING.—H. L. Kauffman. *Oil and Gas News* **13**, (Nov. 5), 16.

PROBLEMS OF THE SMALL REFINER.—J. A. Germany. *Oildom* **14**, 41.

SUCCESSFUL TREATMENT OF CANADIAN TAR SANDS.—*U.S. Commerce Repts.* (Oct. 1), 16.

HOW MOTORISTS OBTAIN THEIR GASOLINE.—T. A. Boyd. *Oil and Gas J.* **22**, (19), 166.

YIELDS FROM VARIOUS GRADES OF CRUDES.—F. B. Koontz. *Oil and Gas J.* **22**, (21), 66.

BREAKING PETROLEUM EMULSIONS.—T. Kuczynski. *Petroleum* **10**, 420.

A REFINING PROCESS WE'RE ASLEEP ON: FRACTIONATING.—E. H. Leslie. *Oil News* (*U.S.A.*) **11**, (Oct. 5), 11.

THE VARIOUS METHODS OF PETROLEUM REFINING.—J. C. Morrell and G. Egloff. *Refiner* **2**, (9), 5.

CENTRIFUGING PETROLEUM EMULSIONS.—E. E. Ayres. *Trans. Am. Inst. Min. and Met. Eng.* (1276). *Oil and Gas J.* **22**, (20), 58. *Nat. Petr. News.* **15**, (41), 32C. *Chem. Abstr.* **17**, 3916. *Min. and Met.* **4**, 527. *Oil Paint and Drug Reporter* **104**, (18), 20.

DESCRIBES ELECTRICAL PROCESS FOR DEHYDRATION OF CUT OIL.—*Oil and Gas J.* **22**, (21), 100.

SOME DON'TS TO BE REMEMBERED IN TREATING OIL.—*Oil News* (*U.S.A.*) **11**, (Sept. 5), 25.

SOME REFINERY PROCESSES AND YIELDS BY VARIOUS METHODS.—F. B. Koontz. *Nat. Petr. News* **15**, (41), 28.

CYLINDRICAL STILLS AND PIPE STILLS COMPARED.—F. N. Williams. *Ref. and Nat. Gas Mfr. Petr. World* **21**, 31.

PATENTS.

PROCESS FOR THE PRODUCTION OF SOLUBLE OR EMULSIFIABLE MINERAL OILS AND THE LIKE.—H. Borck. Ger. Pat. 341,656. *J. Soc. Chem. Ind.* **42**, 1139A.

PROCESS FOR FRACTIONAL DISTILLATION ESPECIALLY OF HYDROCARBONS.—E. E. C. G. Beyer and P. von Ditmar. Ger. Pat. 379,962. *J. Soc. Chem. Ind.* **42**, 1166A.

PURIFICATION OF CRUDE PARAFFIN WAX.—Badische Anilin und Soda-Fabr., Assees. of W. Pungs. Ger. Pat. 379,965. *J. Soc. Chem. Ind.* **42**, 1166A.

FUEL FOR INTERNAL COMBUSTION ENGINES.—A. Grovol. Ger. Pat. 379,966. *J. Soc. Chem. Ind.* **42**, 1166A.

DESULPHURISING HYDROCARBONS.—R. Pchorr. Ger. Pat. 380,059. *J. Soc. Chem. Ind.* **42**, 1166A.

PURIFICATION OF OILS, WAXES AND THE LIKE.—Brit. Pat. 206,535. *Chem. Age* **9**, 665.

PURIFYING LIQUIDS.—J. N. A. Sauer. Brit. Pat. 198,374. *Chem. Abstr.* **17**, 3730.

DESULPHURISING OILS.—A. C. Nesfield. Brit. Pat. 196,680. *Chem. Abstr.* **17**, 3786.

RESOLVING EMULSIONS.—H. A. Gill. Brit. Pat. 195,876. *Chem. Abstr.* **17**, 3786.

PROCESS OF SEPARATING HYDROCARBONS FROM WATER.—W. A. Brown. U.S. Pat. 1,472,384. *J. Soc. Chem. Ind.* **42**, 1214A.

PURIFICATION OF CRACKED HYDROCARBON SPIRIT.—F. G. P. Remfry. Brit. Pat. 205,868. *J. Soc. Chem. Ind.* **43**, B9. *Chem. Age* **9**, 610.

METHOD OF PRODUCING A MATERIAL FOR THE TREATMENT OF OILS (E.G. LUBRICATING OILS).—P. W. Prutzman and C. J. Von Bibra, Assrs. to General Petroleum Corp. U.S. Pat. 1,471,201. *J. Soc. Chem. Ind.* **43**, B9.

PROCESS OF MAKING (MINERAL) OILS NON-SLUDGING.—H. R. Moody. U.S. Pat. 1,472,882. *J. Soc. Chem. Ind.* **43**, B9.

PURIFICATION OF (MINERAL) OILS, WAXES AND THE LIKE.—Oil Refining Improvements Co., Ltd., and J. J. Hood. Brit. Pat. 206,535. *J. Soc. Chem. Ind.* **43**, B47.

REMOVAL OF ASPHALT AND PARAFFIN FROM MIXTURES OF HYDROCARBONS.—H. Neumann. Ger. Pat. 373,589, 373,862. *J. Soc. Chem. Ind.* **43**, B48.

6. NATURAL GAS.

HYDROCARBON GAS IN FRANCE.—*Oil Engineering and Finance* **4**, 498.

HELIUM'S USE IN AIRCRAFT MADE MORE FEASIBLE.—*Chem. and Met. Eng.* **29**, 943.

RARE GASES IN NATURAL GAS.—C. Moureu. *J. Chem. Soc.* **123**, 1905. *Chem. Abstr.* **17**, 3633.

FLOW OF GAS IN PIPES.—S. Lacy. *Gas J.* **163**, 119. *Gas World* **73**, 599. *Chem. Abstr.* **17**, 3775.

THE OIL IN NATURAL GAS OF REFUGIO COUNTY, TEXAS.—L. A. Thiele. *Chem. Age (New York)* **31**, 415.

GASOLINE FROM NATURAL GAS.—G. A. Burrell. *Chem. Met. Eng.* **29**, 544. *Chem. Abstr.* **17**, 3782.

NATURAL GAS IN FRANCE.—*Chronique Industrielle* (Nov. 10). *Oil Engineering and Finance* **5**, 12.

DESCRIPTION AND COST OF CHARCOAL PROCESS PLANTS.—G. A. Burrell. *Oil Trade J.* **14**, (11), 70.

BEGINNINGS OF THE HELIUM DEVELOPMENT.—G. A. Burrell. *Chem. and Met. Eng.* **29**, 1013.

METHOD FOR THE SEPARATION OF GAS MIXTURES.—M. Shepherd and F. Porter. *Ind. Eng. Chem.* **15**, 1143. *J. Soc. Chem. Ind.* **43**, B43.

HELIUM SUCCESSFULLY FLOATS THE GREAT ZR-1.—*Natural Gas* **4**, (Oct.), 3.

PERCENTAGE OF AIR IN GAS LINE SHOWN.—V. Wichum. *Oil and Gas J.* **22**, (22), 72.

NATURAL GAS PRODUCTION AND UTILISATION IN SOUTHERN CALIFORNIA.—H. L. Musser. *Natural Gas* **4**, (Oct.), 18.

NOTES ON EVALUATION OF CASING-HEAD GAS IN THE OKLAHOMA FIELDS.—O. U. Bradley. *Nat. Petr. News* **15**, (41), 30.

"CASING HEAD" DEVELOPMENT.—E. H. Adams. *Union Oil Co. (California) Bull.* **31**, 12.

GASOLINE ABSORPTION PROCESS DESCRIBED.—E. Kay. *Oil and Gas J.* **22**, (12), 52.

INDUSTRIAL GAS SERVICE.—A. A. Scheutz. *Gas. Ind.* **17**, 295.

THE EVOLUTION OF NATURAL GASOLINE.—A. V. Bourque. *Oil and Gas J.* **22**, (19), R-44.

PRODUCTION OF CARBON BLACK FROM NATURAL GAS.—*Natural Gas* **4**, (Sept.), 28.

PRODUCTION OF CARBON BLACK FROM NATURAL GAS IN 1922.—*Ohio Gas and Oil Men's J.* **5**, (Sept.), 11.

SALIENT FEATURES OF THE GAS INDUSTRY SHOW MAGNITUDE.—*Oil and Gas J.* **22**, (3), 102.

PRODUCING CARBON BLACK FROM GAS BY THE HIGH VOLTAGE ARC.—J. J. Jakowsky. *Oil and Gas J.* **22**, (17), 76.

NOTES ON THE NATURAL GAS SITUATION.—T. F. Morgan. *Min. and Oil Bull.* **9**, 783.

PATENT.

SEPARATION OF ADSORBABLE CONSTITUENTS OF GAS AND VAPOUR MIXTURES BY ADSORPTION BY POROUS MATERIALS SUCH AS ACTIVATED CHARCOAL.—Badische Anilin u. Soda-Fabr., Assees. of G. Wietzel and F. Striegler. Ger. Pat. 380,575. *J. Soc. Chem. Ind.* **42**, 1212A.

7. Petrol and Other Motor Fuels.

Motor Fuel from Water Gas.—F. Fischer and H. Tropsch. *Brennstoff-Chem.* (Sept.). *Petr. Times* **10**, 390.

New Motor Fuel in Sweden.—*Oil Weekly* **31**. (7), 65.

New Developments in the Field of Motor Fuels.—W. Ostwald. *Z. angew. Chem.* **35**, 278. *Chem. Abstr.* **17**, 3770.

Several Products which may be Added to Liquid Motor Fuels.—H. Eckart. *Brennstoff-Chem.* **4**, 134. *Chem. Abstr.* **17**, 3770.

New Technical Materials for Combustion Engines.—H. Eckart. *Illustr. Motorzig.* **1922**, 384. *Dinglers polytech. J.* **338**, 29. *Chem. Abstr.* **17**, 3770.

Benzene as a Motor Fuel.—A. C. Fieldner and G. W. Jones. *Chem. and Met. Eng.* **29**, 543. *Chem. Abstr.* **17**, 3770.

Alcohol the Motor Fuel of the Future.—C. C. Green. *Chem. Age* **9**, 84. *Chem. Abstr.* **17**, 3770.

Weighted Index Number for Motor Fuels.—L. Weisberg. *Chem. and Met. Eng.* **29**, 1067.

Standardisation of Motor Fuels.—*Petr. Times* **10**, 892.

Comparative Engine Tests with Crude, Acid Refined and Silica Gel-Refined Motor Benzine.—A. C. Fieldner and G. W. Jones. *U.S. Bureau Mines Repts. Investigations* 2517. *Chem. Abstr.* **17**, 3913.

Alcohol and Benzol in Blended Motor Fuels.—*Petr. Times* **11**, 6.

Detonation in Motor Fuels.—H. Moore. *Chem. Trade J.* **74**, 6. *Chem. Age* **10**, 4.

More about New Ethyl Fuel.—G. A. Burrell. *Petr. Age* **12**, (10), 18.

Gasoline as a Refrigerant.—L. D. Wyant. *U.S. Bureau Mines Repts. Investigations* 2510. *Petr. Age* **12**, (10), 19. *Nat. Petr. News* **15**, (40), 99. *Chem. Abstr.* **17**, 3783.

Weighted Index Number for (Volatility of) Motor Fuels.—W. A. Gruse. *Chem. and Met. Eng.* **29**, 970. *J. Soc. Chem. Ind.* **43**, B44.

Motor Spirit from Animal and Vegetable Fats.—*Petr. Times* **11**, 101.

How Shall we Measure the Volatility of Motor Fuels?—*Chem. and Met. Eng.* **30**, 24.

Natural Gas Gasoline in 1922.—*Petr. Age* **12**, (12), 61.

A New Fuel for Explosion Motors from Tar Distillation.—L. Roman. *Chim. et Ind.* **9** (Special No.), 583.

Blended Fuels for Automotive Engines.—J. C. Smallwood. *Oildom* **14**, (Nov.), 50.

Alcohol as Fuel.—E. Haddon. *Rev. agr. Maurice* **1**, 129.

Blended Fuels for Automotive Engines.—*Petr. World* **20**, 508.

FRENCH EXPERIMENTS IN ALCOHOL MIXTURE.—*Oil and Gas J.* **22**, (15), 133.

THE FUEL QUESTION FROM THE STANDPOINT OF COMMON CARRIERS IN THE CITY OF LONDON.—O. W. J. Watson. *Chim. et ind.* **9** (Special No.), 675.

MOTOR FUELS, ESPECIALLY ALCOHOL.—F. L. Nathan. *Chim. et Ind.* **9** (Special No.), 627.

SPARK-ADVANCE IN INTERNAL-COMBUSTION ENGINES.—G. B. Upton. *J. Soc. of Auto Eng.* **13**, 111.

RECENT GERMAN CARBURETTOR DESIGNS STRESS USE OF CHEAPER FUELS.—B. R. Dierfeld. *Auto Ind.* (July 26), 177.

GASOLINE SAVED ON GOVERNMENT TRUCKS BY ADJUSTING CARBURETTORS BY EXHAUST GAS ANALYSIS.—G. W. Jones and A. C. Fieldner. *U.S. Bureau of Mines Repts. Investigations* 2487. *Ohio Gas and Oil Men's J.* **5**, (Sept.), 23.

THE FUTURE MOTOR FUEL.—W. K. Lewis. *Oildom* **14**, (Nov.), 52.

"BENTYL," A NEW SWEDISH MOTOR FUEL.—*U.S. Commerce Repts* (Oct. 29), 283.

NEW SWISS CARBURETTOR HAS NOVEL FEATURES.—G. Willrich. *U.S. Commerce Repts.* (Aug. 20), 463.

PLANT RESOURCES FOR MOTOR FUEL.—*Journal Franklin Institute* **196**, 418.

RULES ON STATIC ELECTRICITY.—*Oildom* **14**, (Sept.), 19.

THE FUTURE MOTOR FUEL.—W. K. Lewis. *Oildom* **14**, (Sept.), 40.

PATENTS.

LIQUID FUEL.—General Motors Research Corporation.—Brit. Pat. 196,237. *Chem. Abstr.* **17**, 3778.

INCORPORATING "ANTI-KNOCK" SUBSTANCES WITH MOTOR FUEL.—F. E. Aseltine. U.S. Pat. 1,467,222. *Chem. Abstr.* **17**, 3779.

UTILISATION OF ALCOHOL IN THE PRODUCTION OF LIQUID FUEL.—A. E Dunstan and F B Thole. Brit. Pat. 205,367. *J. Soc Chem. Ind.* **42**, 1213A.

INFLAMMABLE VAPORISABLE LIQUID FUELS.—P Lennox and J. C. Calder. Brit. Pat. 205.582. *J. Soc Chem. Ind.* **42**, 1213A.

MOTOR FUEL.—J. J Murphy. U.S. Pat. 1,471,566. *J Soc. Chem. Ind.* **42**, 1213A.

MOTOR FUEL.—W. C. Perry. U.S. Pat. 1,471,916. *J. Soc. Chem. Ind.* **42**, 1213A.

NON-FREEZING (MOTOR) FUEL: MOTOR FUEL.—W. T. Schreiber, Assr. to U.S. Industrial Alcohol Co. U.S. Pat. 1,474,982-3.

LIQUID FUEL FOR MOTORS.—A A. Backhaus, Assr. to U S Industrial Alcohol Co. U.S. Pat. 1,474.135 *J Soc. Chem Ind* **42**, 847.

CARBURETTOR.—W. M. Gentle. U.S. Pat. 1,473,182.

CARBURETTOR.—R. S. Hill. U.S. Pat. 1,472,834.

CARBURETTOR.—W. A. McCulla. U.S. Pat. 1,473,113.

CARBURETTOR.—G. Christian. U.S. Pat. 1,466,789.

CARBURETTOR.—D. Cole and C. J. Gustafson. U.S. Pat. 1,461,970.

CARBURETTOR.—B. M. Dawson. U.S. Pat. 1,468,358.

CARBURETTOR-CONTROLLING DEVICE.—F. Forney and R. H. Hoff. U.S. Pat. 1,461,521.

CARBURETTOR FOR INTERNAL COMBUSTION ENGINES. L. T. Godfrey-Evans. U.S. Pat. 1,470,820.

CARBURETTOR.—B. N. Pierce. U.S. Pat. 1,472,615.

CARBURETTOR.—R. F. Proctor and W. R. Proctor. U.S. Pat. 1,467,067.

CARBURETTOR.—A. Wagner. U.S. Pat. 1,462,219.

MULTIFLUID CARBURETTOR.—G. G. Westerfield. U.S. Pat. 1,470,659.

10. LUBRICANTS AND LUBRICATION.

MODERN LUBRICANTS AND THEIR APPLICATION.—*Daily Telegraph. Petr. World* **20**, 520.

LUBRICATION OF POWER FARMING MACHINERY.—*Lubrication* **9**, 73.

LUBRICATION OF STEAM TRACTION ENGINES.—*Lubrication* **9**, 82.

DRIVING CHAINS AND THEIR LUBRICATION.—*Lubrication* **9**, 85.

LUBRICATION OF ROAD-BUILDING MACHINERY.—*Lubrication* **9**, 92.

COMMERCIAL LUBRICATING OILS.—J. Lévy. *Tech. moderne* **15**, 522. *Chem. Abstr.* **17**, 3784.

LUBRICANTS FOR INTERNAL-COMBUSTION ENGINES.—B. Knutson. *Tech. Tids.* **53**, (Kemi), 49. *Chem. Abstr.* **17**, 3784.

DISCUSSION OF AUTOMOBILE OILS.—A. C. Carpenter. *Nat. Petr. News* **15**, (37), 18. *Chem. Abstr.* **17**, 3784.

STEAM TURBINES AND THEIR LUBRICATION.—F. A. Hoff. *Oil News* (*U.S.A.*) **11**, (17), 15. *Chem. Abstr.* **17**, 3784.

DETERIORATION OF TURBINE OILS IN USE.—A. Duckham and S. E. Bowrey. *Engineering* **116**, 353. *Chem. Abstr.* **17**, 3784.

RECLAMATION OF USED PETROLEUM LUBRICATING OILS.—W. H. Herschel and A. H. Anderson. U.S. Bureau. *Standards Tech. Paper* 223. *Chem. Abstr.* **17**, 3916.

OIL FOR MOTOR-ENGINE LUBRICATION.—H. Moore. *Oil Engineering and Finance* **5**, 52.

BALL-BEARING LUBRICATION.—A. Duckham and S. E. Bowrey. *Engineering* **116**, 612. *Oil Engineering and Finance* **5**, 53.

PROPERTIES OF LUBRICATING OILS.—A. C. Carpenter. *Oil News* (*U.S.A.*) **11**, (Oct. 5), 17.

LUBRICATION—ITS CHEMICAL CAUSES AND FEATURES.—A. E. Dunstan and F. B. Thole. *Bessemer Monthly* (213), 3. *Ref. and Nat. Gas. Mafr.* **2**, (6), 15.

DIE MINERALSCHMIERÖLE, IHRE HARSTELLUNG, BESCHAFFENHEIT UND PRÜFUNG.—R. Kissling. *Chem. Zeit.* **47**, 77, 100.

OILS FOR STEAM PUMPS AND STEAM CYLINDERS.—F. A. Hoff. *Oil News* (*U.S.A.*) **11**, (Nov.), 40.

PATENTS.

LUBRICANT.—H. Kurata. U.S. Pat. 1,466,022. *Chem. Abstr.* **17**, 3787.

MANUFACTURE OF LUBRICANTS.—Plauson's (Parent Co.), Ltd. Brit. Pat. 208,267. *Chem. Age* **10**, 99.

11. FUEL OIL.

MECHANICAL FUEL-OIL BURNING SYSTEMS.—*Schutte and Koerting, Bull.* 16-0A, 16-0G, and 17-9.

SUBSTITUTING FUEL OIL FOR PRODUCER GAS IN A CONTINUOUS GLASS TANK.—F. S. Thompson. *J. Am. Ceram. Soc.* **6**, 1050.

FUEL OIL AS ADAPTED TO THE CHAMBERED CONTINUOUS KILN.—*J. Am. Ceram. Soc.* **6**, 1056.

OIL-FUEL BURNING AT SEA AND ON LAND.—J. S. Gander. James Munro and Co., Ltd., Glasgow.

FUEL OIL CHARACTERISTICS AND ADVANTAGES AS COMPARED WITH COAL.—A. P. Bjerregaard. *Nat. Petr. News* **15**, (42), 32A.

THE PRACTICAL USE OF OIL FUELS.—A. F. Brewer. *Combustion* **9**, 229, 311, 379.

FURNACE OIL NEW MARKET FOR PETROLEUM.—N. O. Fanning. *Oil and Gas J.*, **22**, (20), 64.

SOME PRINCIPLES AFFECTING DOMESTIC BURNERS.—L. E. French. *Oil News* (*U.S.A.*) **11**, (Oct. 5), 27.

PRACTICAL CONSIDERATION ON FUEL OIL AND ITS APPLICATIONS.—M. De Brey. *Chim. et Ind.* **9**, (Special No.), 239.

FUEL OIL AND VISCOSITY.—M. G. Langham. *Power* **58**, 423.

12. DIESEL OIL AND ENGINES.

RECENT DEVELOPMENTS OF THE HEAVY-OIL ENGINE.—W. P. Sillence. *Oil Engineering and Finance* **5**, 27.

MARINE PROPULSION DURING FIFTY YEARS.—Sir J. Fortescue Flannery, Bart. Junior Inst. of Engineers. *Petr. Times* **11**, 115.

Test with Vegetable Oils in Diesel and Semi-Diesel Engines.—P. Delahousse. *Chim. et Ind.* **9**, (Special No.), 764.

Fuels for Diesel Engines.—R. Ponchon. *Chim. et Ind.* **9**, (Special No.), 285.

Sole Considerations Affecting the Choice of a Heavy Oil Engine.—G. Porter, Diesel Engine Users' Assoc. *Petr. World* **20**, 511.

Patents.

Method and Means for Atomising and Gasifying Heavy Combustibles for Internal Combustion Engines, Furnaces, or the like.—C. Chilowsky. Brit. Pat. 183,828. *J. Soc. Chem. Ind.* **42**, B46.

Diesel Engine.—P. Hentschke. U.S. Patent 1,464,906.

13. Plant and Machinery.

Distilling Column Elements.—J. A. Steffens. *Chem. Age* (*New York*) **31**, 75. *Chem. Abstr.* **17**, 3729.

Centrifugal Pumps for Oil Pipe-Lines.—*Chem. and Met. Eng.* **29**, 1021.

Use of Aluminium to Prevent Steel Corrosion.—A. V. Farr. *Chem. and Met. Eng.* **29**, 1188.

Preventing Losses in Oil Refining.—The Calorising Co. *Chem. and Met. Eng.* **29**, 1194.

Handling Hot Oils a Real Refiner Problem.—E. Matheson. *Refiner* **2**, (9), 11.

Problems met in Refinery Construction.—R. L. Waldo. *Oil and Gas Jour* **22**, (22), 84.

Patents.

Machines for Emulsifying Materials.—H. Povey and H. O. Hallas. Brit. Pat. 204,349. *J. Soc. Chem. Ind.* **42**, 1160.

Distillation of Hydrocarbon Oils.—T. E. Robertson. From The Power Specialty Co. Brit. Pat. 206,029. *Chem. Age* **9**, 611. *J. Soc. Chem. Ind.* **43**, B9.

Centrifugal Separators.—Brit. Pat. 206,585.—The Grange Iron Co. and H. P. Hoyle. *Chem. Age* **9**, 665.

Distilling Hydrocarbon Oils.—E. H. French. Brit. Pat. 196,306.

Refining Petroleum.—P. T. Sharples. Brit. Pat. 197,389.

Distilling Petroleum, etc.—Brünn-Konigsfelder Maschinenfabrik der Maschinen und Waggonbau Fabriks Akt.-Ges. vorm. H. D. Schmid and K. Fuchs. Brit. Pat. 196,624. *Chem. Abstr.* **17**, 3786.

Electrical Apparatus for Dehydrating Petroleum Oils.—R. E. Land. U.S. Pat. 1,467,003.

APPARATUS FOR DISTILLING OIL.—T. E. Robertson. From Power Specialty Co. Brit. Pat. 207,041. *Chem. Age* **9**, 91.

PRODUCTION OF PETROL AND LIKE MOTOR SPIRITS.—F. Tinker. Brit. Pat. 205,289. *J. Soc. Chem. Ind.* **42**, 1213A.

PROCESS OF DISTILLING (PETROLEUM) OIL.—H. L. Doherty. U.S. Pat. 1,472,116. *J. Soc. Chem. Ind.* **42**, 1214A.

MEANS FOR SWEATING OF PARAFFIN AND LIKE WAXES.—F. Esling, and S. H. Johnson and Co., Ltd. Brit. Pat. 205,245. *J. Soc. Chem. Ind.* **42**, 1214A.

CENTRIFUGAL APPARATUS FOR SEPARATING AND FILTERING LIQUIDS.—C. F. Paul. U.S. Pat. 1,468,740. *Chem. Abstr.* **17**, 3812. *Chem. and Met. Eng.* **29**, 1023.

CENTRIFUGAL SEPARATORS (FOR OIL AND WATER).—Aktiebolaget Separator. Brit. Pat. 204,047. *J. Soc. Chem. Ind.* **43**, B9.

PROCESS OF REFINING (MINERAL) OIL.—C. B. Forward. U.S. Pat. 1,473,402. *J. Soc. Chem. Ind.* **43**, B9.

IMPROVED WAX PRESS.—H. F. Glair and E. J. Wonnacott. U.S. Pat. 1,474,899, Assgnd. to Standard Oil Co. *Chem. and Met. Eng.* **29**, 1108. *J. Soc. Chem. Ind.* **43**, B47.

OIL FILTER.—C. Wood, Assgn. to Wyne Oil Tank and Pump Co. U.S. Pat. 1,471,994. *Petr. Age* **12**, (10), 62.

DISTILLING OR REFINING COLUMN.—E. Piron, Assr. to Piron Coal Distillation Systems, Inc. U.S. Pat. 1,475,243. *J. Soc. Chem. Ind.* **43**, B41.

PURIFYING OR SEPARATING APPARATUS FOR LIQUIDS.—K. J. Svensson and K. A. P. Norling. Brit. Pat. 206,475. *J. Soc. Chem. Ind.* **43**, B41.

SEPARATORS FOR MIXTURES OF FLUIDS OF DIFFERENT DENSITIES.—C. S. Lenz and G. E. Jupp. Brit. Pat. 206,882.

CENTRIFUGALLY SEPARATING REFRIGERATED INGREDIENTS (E.G. PARAFFIN-WAX FROM MINERAL OILS) AND CENTRIFUGAL BOWL USED IN SUCH PROCESS.—C. H. Hapgood, Assr. to De Laval Separator Co. U.S. Pat. 1,472,868. *J. Soc. Chem. Ind.* **43**, B47.

PETROLEUM REFINING APPARATUS.—C. B. Watson. U.S. Pat. 1,474,395. *J. Soc. Chem. Ind.* **43**, B47.

PROCESS AND APPARATUS FOR RESOLVING EMULSIONS.—C. H. Hapgood, Assr. to De Laval Separator Co. U.S. Pat. 1,474,670. *J. Soc. Chem. Ind.* **43**, B47.

APPARATUS FOR SEPARATING OIL FROM OIL-BEARING SANDS AND ROCKS.—W. J. Reilly. U.S. Pat. 1,475,028. *J. Soc. Chem. Ind.* **43**, B47.

OIL RECLAIMER AND PURIFIER.—H. W. Rose. U.S. Pat. 1,475,086. *Petr. Age* **12**, (12), 72.

BURNER FOR LIQUID FUEL.—E. Cleary. U.S. Pat. 1,475,050. *Petr. Age* **12**, (12), 72.

CENTRIFUGAL SEPARATOR.—C. W. Eccleston. U.S. Pat. 1,473,421.

FUEL-OIL FILTER.—W. Inman. U.S. Pat. 1,468,906.

Electrical Dehydrator.—R. E. Land. U.S. Pat. 1,467,003.

Method and Apparatus for Treating Materials for Filtering, Decolorising, and similar Purposes.—F. W. Manning. U.S. Pat. 1,473,491.

Process for Reclaiming Used Oil.—J. R. Miller. U.S. Pat. 1,469,426.

Apparatus for Distilling Volatile Impurities from the Lubricating Oil of Internal-Combustion Engines.—E. E. Sweet. U.S. Pat. 1,471,984.

Oil Filter.—C. Wood. U.S. Pat. 1,471,904.

Distillation Apparatus.—J. Zander. U.S. Pat. 1,468,435.

Oil Filter.—R. S. Moore and Jones. U.S. Pat. 1,461,627.

Distillation Apparatus.—W. A. Peters. U.S. Pat. 1,466,411.

14. Testing, Analysis and Apparatus.

Estimation of Total Carbon in Fuels.—E. Goutal. *Fuel* **2**, 344. *J. Soc. Chem. Ind.* **42**, 1162A.

Tag Manual for Inspectors of Petroleum.—R. M. Wilhelm (18th revised edition). C. J. Tagliabue Mfg. Co., Brooklyn, N.Y.

Oil Analysis.—A. H. Gill. J. B. Lippincott Co.

The Vapour Pressures of Gasolines and Light Petroleum Naphthas.—F. H. Rhodes and E. C. McConnell. *Ind. and Eng. Chem.* **15**, 1273.

Capillary Tube Viscometers.—G. Barr. *J. of Scient. Instruments* **1**, 81, 111.

The Surface-Tension Balance.—R. G. Green. *Ind. and Eng. Chem.* **15**, 1024.

A New Apparatus Suitable for the Determination of Organic Vapours (Benzene, Benzine), in Gases by the Use of Activated Carbon.—R. Kattwinkel. *Brennstoff-Chem.* **4**, 179. *Chem. Abstr.* **17**, 3630.

The Combustion of Methane in the Presence of Glowing Platinum.—J. W. Whitaker. *Fuel* **2**, 201. *Chem. Abstr.* **17**, 3770.

Secondary) Higher Alcohols from Petroleum Olefines.—W. W. Clough and C. O. Johns. *Ind. and Eng. Chem.* **15**, 1030. *J. Soc. Chem. Ind.* **42**, 1198A.

Tentative Method of Test for Water in Petroleum Products.—*Nat. Petr. News* **15**, (42), 101.

Aniline as an Analytical Reagent in Fuel Chemistry.—D. Holde and S. Weill. *Brennstoff-Chem.* **4**, 177. *Chem. Abstr.* **17**, 3771.

Determination of Small Amounts of Moisture in Transformer Oils.—A. Philipp. *Bayerischen Indusien u. Gewerbeblatt* **1922**. *Rev. Chim. Ind.* **32**, 226. *Chem. Abstr.* **17**, 3784.

Applications of Vapour Pressure Measurements.—H. S. and M. D. Davis. *Ind. Eng. Chem.* **15**, 1075. *Chem. Abstr.* **17**, 3811.

An Improved Method for the Separation of Gas Mixtures.—M. Shepherd and F. Porter. *Ind. Eng. Chem.* **15**, 1143. *Chem. Abstr.* **17**, 3811.

The Dependence of the Hefner Lamp on Atmospheric Pressure.—E. Liebenthal. *Z. Instrumentenk.* **43**, 209. *Chem. Abstr.* **17**, 3827.

Measurement of the Relative Absorption Efficiencies of Gas-Absorbent Oils.—R. E. Wilson and H. S. Davis. *Ind. Eng. Chem.* **15**, 947. *Chem. Abstr.* **17**, 3913.

Surface Tension Balance.—R. G. Green. *Ind. and Eng. Chem.* **15**, 1024. *J. Soc. Chem. Ind.* **42**, 1204A.

Dew-Point, a Volatility Test.—W. A. Gruse. *Petr. Age* **12**, (10), 20.

The Solvent-Index of Refraction Method of Determining Oil in Wax.—R. E. Wilson and R. E. Wilkin. *Ind. and Eng. Chem.* **16**, 9.

British Standard Method for the Determination of Viscosity in Absolute Units.—*British Engineering Standards Assoc. Publication* 188. *Chem. Trade J.* **74**, 71.

(Laboratory) Fractional Distillation Apparatus.—E. H. Nason. *Ind. Eng. Chem.* **15**, 1188. *J. Soc. Chem. Ind.* **43**, B78.

Eine Neue Apparatus für exakte Gas Analyse.—K. A. Shaller and W. Berndt. *Chem. Zeit.* **46**, 972.

Determination of the Tar Number of Mineral Oils.—E. Casimir. *Petroleum* **19**, 763.

Total and 1-inch Immersion Conversion Table.—*Nat. Petr. News* **15**, (41), 42.

Apparatus for the Rapid Analysis and Regulation (Determination of Viscosity) of Highly Viscous Substances.—G. F. Dierfield. *Chem. News* **127**, 228. *J. Soc. Chem. Ind.* **42**, 1252A.

Three Changes made in Tentative Test Method for Flash.—*Nat. Petr. News* **15**, (41), 41.

Tentative Method of Testing Gas Oils.—*Nat. Petr. News* **15**, (43), 73.

Viscosimeter.—E. Stern. *Chem. Zeit.* **47**, 291.

Viscosity.—R. Boan. *Chem. Eng. and Min. Rev.* **15**, 297.

Patent.

Method of Effecting Solution of Substances (Separation of Saturated and Unsaturated Hydrocarbons) and Removing Coatings from Bodies.—V. Lenher. U.S. Pat. 1,473,350. *J. Soc. Chem. Ind.* **43**, B47.

15. Cracking and Hydrogenation.

The Economic Aspects of Cracking Oils.—C. M. Johnson. *Refiner Oil Engineering and Finance* **4**, 507.

THE CRACKING OF MEXICAN GAS OILS.—G. Egloff. *Petr. World* **20**, 489.

CROSS CRACKING PROCESS.—Gasoline Products Co.

MUEHL CRACKING PROCESS.—*Oil and Gas J.* **22**, (14), 42.

THE HYDROGENATION OF HYDROCARBON OILS.—H. G. Shatwell. *Fuel* **2**, 229.

PETROL PRODUCTION BY THE CATALYTIC METHOD.—*La Revue Pétrolifère* (Dec.). *Petr. Times* **11**, 16.

PETROLEUM REFINING.—G. Egloff. Amer. Chem. Soc. *Petr. Times* **11**, 86.

THE BLUMNER PROCESS FOR OBTAINING BENZINE AND LUBRICANTS.—O. Arendt. *Petroleum* **19**, 1285. *Petr. Times* **11**, 82.

NEW FACTS RELATING TO THE BERGIUS PROCESS.—P. Bruylante. *Bull. de la Société Chimique Belge. Petr. Times* **11**, 100.

HYDROGENATION OF COAL AND OF HEAVY OILS.—A. Stouvenot. *Mines Carrières* **1**, 57. *Chim. et Ind.* **9**, 1153.

CRACKING OF MID-CONTINENT FUEL OIL.—G. Egloff. *Oil and Gas J.* **22**, (19), 188.

THE METHOD OF WORKING THE BURTON CRACKING PROCESS.—A. Faber. *Petroleum* **19**, 643.

HOW THE HEAVY LONG BEACH RESIDUE IS BEING CRACKED BY THE DUBBS' PROCESS TO PRODUCE HIGH YIELDS OF MARKETABLE GASOLINE AND OTHER VALUABLE CONSTITUENTS.—G. Egloff. *Petr. World* (*Los Angelos*) **8**, (Oct.), 21.

MORE GASOLINE FROM CRUDE OIL BY DENVER CHEMIST'S NEW PROCESS.—*Salt Lake Mining Review* **25**, (Sept. 15), 24.

ELECTRIC SPARKS USED IN THE STEVENS PROCESS.—E. W. Stevens. *Ref. and Nat. Gas Mfr.* **2**, (3), 17.

PATENTS.

PROCESS FOR GASIFYING (AND CRACKING) CRUDE PETROLEUM OR PETROLEUM DISTILLATES.—K. Smolkenski. Ger. Pat. 376,304. *J. Soc. Chem. Ind.* **42**, 1166A.

RETORTS.—A. F. Maclauren and Safe Superheat, Ltd. Brit. Pat. 198,063. *Chem. Abstr.* **17**, 3630.

CRACKING HYDROCARBONS.—D. W. Hovey. Brit. Pat. 197,372. *Chem. Abstr.* **17**, 3785.

CRACKING HYDROCARBONS.—S. L. Gartlan and A. E. Gooderham. Brit. Pats. 197,494-5. *Chem. Abstr.* **17**, 3785.

CRACKING HYDROCARBON OILS.—D. T. Day. U.S. Pat. 1,467,758. *Chem. Abstr.* **17**, 3785.

CRACKING HYDROCARBON OILS.—B. van Steenberger. Brit. Pat. 198,071. *Chem. Abstr.* **17**, 3785.

FURNACE FOR CRACKING.—F. Pfeifer. U.S. Pat. 1,466,511.

Process of Producing Low Boiling (Hydrocarbon) Oils.—G. L. Prichard and H. Henderson, Assrs. to Gulf Refining Co. U.S. Pat. 1,473,316. *J. Soc. Chem. Ind.* **43**, B9.

Apparatus for Treating Oil.—G. Egloff and H. P. Benner, Assrs. to Universal Oil Products Co. U.S. Pat. 1,470,353. *Petr. Age* **12**, (10), 62. *Chem. Abstr.* **17**, 3917.

Cracking Hydrocarbons.—R. W. Hanna. Brit. Pat. 195,422. *Chem. Abstr.* **17**, 3603.

Distilling and Cracking Petroleum.—J. L. Gray. U.S. Pat. 1,474,147. *J. Soc. Chem. Ind.* **43**, B47. *Petr. Age* **12**, (12), 72.

Method of Treating Petroleum.—D. W. Hoge, Assr. to Bash Oil and Refining Co. U.S. Pats. 1,474-475-6. *J. Soc. Chem. Ind.* **43**, B47.

Process and Apparatus for Cracking Oils.—J. F. Monnet. Brit. Pat. 208,310. *Chem. Age* **10**, 99.

Process for Transforming Liquids into Liquids of Lower Boiling Point.—S. J. M. Auld. Brit. Pat. 208,569. *Chem. Age* **10**, 99.

Distillation and Cracking of Mineral Oils and other Hydrocarbon-containing Material.—N. V. S. Knibbs. U.S. Pat. 1,459,156.

Apparatus for Cracking Oils.—W. B. D. Penniman. U.S. Pat. 1,459,515.

Cracking Furnace.—F. Pfeifer. U.S. Pat. 1,466,511.

16. Insulating Oils.

Technical Specifications for Transformer and Switch Oils.—*Petroleum* **19**, 838. *Chem. Abstr.* **17**, 3785.

17. Shale and Shale-Oils.

Extraction of Oil from Shale.—G. W. Wallace. *Chem. Age* **9**, 625.

Research Work on Oil-Shale.—*Chem. and Met. Eng.* **29**, 971.

Shale Development in California.—D. T. Day. *Oil Engineering and Finance* **4**, 503.

The Burmese Oil-Shales and their Exploitation.—R. H. Crozier. *Mining Magazine* **29**, 265. *Petr. Times* **10**, 774.

Organic Matter of Colorado Oil-Shales.—A. J. Franks and B. D. Goodier. *Oil Engineering and Finance* **4**, 175, 257. *Chem. Abstr.* **17**, 3782.

Oil-Shales of Colorado and Indiana Compared.—D. E. Winchester. *Railroad Red Book* **40**, 823. *Chem. Abstr.* **17**, 3782.

Oil-Yielding Rocks in the Union of South Africa.—T. G. Trevor. *Oil Engineering and Finance* **4**, 253, 277, 301. *S. Afr. J. Ind.* **6**, 285. *Chem. Abstr.* **17**, 3854. *Petr. World* **20**, 358, 496; **21**, 22.

The Day Shale Retorting Plant.—*Oil Engineering and Finance* **5**, 23.

THE FUEL OIL OF THE FUTURE.—*Petr. Times* **11**, 24.

FROM SHALE FUTURE FUEL OIL.—R. A. Cheseborough. *Petr. Age* **12**, (10), 50.

THE OIL SHALES OF SOMERSET.—F. Leslie. *Petr. Times* **11**, 118.

THE ESTHONIAN STATE OIL-SHALE INDUSTRY.—*Petr. Times* **11**, 121.

OIL SHALE—A COMPREHENSIVE SURVEY.—V. C. Alderson. *Min. Cong. J.* **9**, 383.

THERMAL DECOMPOSITION OF SHALE OILS UNDER PRESSURE.—C. W. Botkin. *Railroad Red Book* **40**, 887.

CONCERNING BITUMINOUS "CYPRISSCHIEFER" IN BOHEMIA.—St. Landa. *Petroleum* **19**, 501.

FUEL OIL FROM SHALE.—R. Cross. *Oil and Gas News* **13**, (Nov. 5), 18.

BRIEF DESCRIPTION OF THE FRENCH BITUMINOUS SHALES.—Brunschweig. *Chim. et Ind.* **9** (Special No.), 394.

BITUMINOUS SHALES.—A. Cambray. *Chim. et Ind.* **9** (Special No.), 398.

SCOTCH BITUMINOUS SHALES.—E. M. Bailey. *Chim. et Ind.* **9** (Special No.), 423.

MODERN FURNACES FOR THE DISTILLATION OF BITUMINOUS SHALES.—C. Berthelot. *Chim. et Ind.* **9** (Special No.), 439.

NOTE ON THE ESTHONIAN SHALE DEPOSITS.—M. E. De Jarny. *Chim. et Ind.* **9**, (Special No.), 429.

THE OIL-SHALES OF THE UNITED STATES AND THE FUTURE OF THE PETROLEUM SUPPLY.—R. H. Tingley. *Outlook* **135**, 269.

PATENTS.

DISTILLING SHALE.—United Kingdom Oil Co., Ltd., G. F. Forwood and J. G. Tapley. Brit. Pat. 197,069. *Chem. Abstr.* **17**, 3786.

APPARATUS FOR DISTILLING OIL FROM SHALE.—J. Zander. U.S. Pat. 1,468,435. *Chem. Abstr.* **17**, 3787.

PROCESS FOR OBTAINING OILS FROM SHALES AND NON-CAKING COALS.—H. Edwards and G. Young. Brit. Pat. 207,073. *Chem. Age* **9**, 692.

SHALE RETORT.—W. A. Lamb, assr. to L. S. Ballantine. U.S. Pat. 1,471,492. *J. Soc. Chem. Ind.* **42**, 1213A.

RETORT FOR THE DISTILLATION OF SHALE.—C. M. Garland. U.S. Pat. 1,473,616. *J. Soc. Chem. Ind.* **43**, B8.

DISTILLATION OF BITUMINOUS MATERIAL.—M. Gercke. U.S. Pat. 1,473,357. *J. Soc. Chem. Ind.* **42**, B9.

ISOLATION OF HIGH-GRADE OIL AND TAR FROM SHALE.—C. Engler. Ger. Pat. 380,331. *J. Soc. Chem. Ind.* **43**, B47.

PROCESS AND APPARATUS FOR EXTRACTING HYDROCARBON OIL MATERIAL FROM OIL-BEARING EARTHY MATERIAL.—D. T. Day. Brit. Pat. 208,586. *Chem. Age* **10**, 99.

18. Lignites and Coals and Their Products.

Low-Temperature Tar from Bituminous Coal.—J. J. Morgan. *Chem. and Ind.* **42**, 1178.

New Low-Temperature Coal-Distillation Plant.—Can. Chem. and Met. (Sept.). *Chem. and Ind.* **42**, 1166.

Low-Temperature Coal-Tar.—A. Weindel. *Brennstoff-Chem.* **4**, 321. *J. Soc. Chem. Ind.* **42**, 1168A.

Coal and the Liquid Fuel Problem.—E. Audibert. *Chim. et Ind.* **10**, 613. *Chem. Age* **9**, 635.

Lignite Resources of Italy.—*U.S. Commerce Repts.* (*Oct.*), 105.

Liquid Fuels from Coal a Result of Chemical Research.—Auto-Industries (Aug. 30). *Gas Age-Record* **52**, 307.

The Lignite Industry.—J. Chanzy. *Rev. ind. Minérale*, **1923**, 259. *Bergwerks Zeit.* (June 6).

Investigations in Germany on the Distillation of Coal at Low Temperatures.—E. Audibert and A. Raineau. *Rev. ind. Minérale*, **1923**, 275.

Products Yielded by Carbonisation of Coal at Low Temperatures.—J. D. Davis. *Fuels and Furnaces* **1**, 336. *Chem. Abstr.* **17**, 3775.

Determination of the Aromatic and Unsaturated Constituents of Low-Temperature Tar.—H. Arnold. *Z. angew. Chem.* **36**, 545. *J. Soc. Chem. Ind.* **42**, 1215A.

The Tertiary Brown Coal Forests of the Geiseltal.—R. Zander. *Braunkohle* **22**, 17, 38. *Chem. Abstr.* **17**, 3853.

Some Brown Coal and Dysodile Deposits of the Vogelberg.—K. Hummel. *Braunkohle* **22**, 53, 68, 100. *Chem. Abstr.* **17**, 3853.

Low-Temperature Carbonisation.—V. Z. Caracristi. *Power* **57**, 831. *Am. Gas J.* **119**, 65, 76. *Chem. Abstr.* **17**, 3914.

Potentialities of Low-Temperature Distillation in the Conservation of our Fuel Resources.—V. L. Caracristi. *Chem. Age* (*New York*) **31**, 361. *Chem. Abstr.* **17**, 3914.

Low-Temperature Tars.—H. Moore. *Oil Engineering and Finance* **5**, 41.

The Low-Temperature Treatment of Coal with By-Product Recovery.—W. Beswick and A. T. Grisenthwaite. *Iron and Coal Trades Rev.* (Dec. 14), 885.

Low Temperature Carbonisation.—H. E. Armstrong. Inst. of Civil Engineers. *Gas World* (Dec. 22). *Chem. Age* **10**, 24.

Gas Producer Methods in Carbonising Coal.—C. H. S. Tupholme. *Chem. and Met. Eng.* **29**, 1138.

Low-Temperature Tar from Prince Hardenberg Coal, with Special Reference to the Benzene, Phenol and Acetone Content.—H. Broche. *Ber.* **56B**, 1787. *Chem. Abstr.* **17**, 3776.

THE RELATIONS BETWEEN LOW AND HIGH TEMPERATURE COAL TARS AND PETROLEUM WITH REMARKS ON THE CONTRIBUTIONS OF F. SCHUTZ AND H. BROCHE.—F. Fischer. *Ber.* **56B**, 1791. *Chem. Abstr.* **17**, 3776.

CHEMICAL COMPOSITION OF LIGNITE TARS.—J. F. Pfaff and A. Kreutzer. *Z. angew. Chem.* **36**, 437. *Chem. Abstr.* **17**, 3777.

THE LIGNITE INDUSTRY.—E. Marcotte. *Rev. Scient.* **61**, 618. *Chem. Age* **4**, 729.

CARBONISING COAL BY THE SENSIBLE HEAT OF PRODUCER GAS.—C. H. S. Tupholme. *Chem. and Met. Eng.* **29**, 1008.

GRADED TEMPERATURE ZONES IN COAL CARBONISATION.—C. H. S. Tupholme. *Chem. and Met. Eng.* **30**, 54.

WHERE LOW-TEMPERATURE DISTILLATION STANDS.—C. H. S. Tupholme. *Combustion* (*Jan.*), 57.

METHODS OF INVESTIGATION OF LIGNITE.—E. Damour and M. Laffargue. *Chim. et Ind.* **9**, (Special No.), 466.

MODERN OVENS FOR THE LOW-TEMPERATURE CARBONISATION OF LIGNITES.—C. Berthelot. *Chim. et Ind.* **9**, (Special No.), 470.

THE LIQUID FUEL PROBLEM IN ITS RELATION TO THE LOW-TEMPERATURE CARBONISATION OF COAL.—E. Connerade. *Chim. et Ind.* **9**, (Special No.), 531.

THE PRODUCTION OF LOW-TEMPERATURE TAR AND ITS TRANSFORMATION INTO MOTOR FUEL.—F. Fischer. *Chem. Weekblad* **20**, 390.

CONDENSATION, DISTILLATION AND RECOVERY OF BY-PRODUCTS FROM LIGNITES.—C. Mariller. *Chim. et Ind.* **9**, (Special No.), 492.

THE TREATMENT OF TARS AND OF BENZENES FOR THE PRODUCTION OF LIQUID FUELS.—F. Peiffert. *Chim. et Ind.* **9**, (Special No.), 542.

PATENTS.

PROCESS AND APPARATUS FOR THE DISTILLATION OF BITUMINOUS SUBSTANCES TO YIELD LOW-TEMPERATURE TAR.—H. Koppers. Ger. Pat. 375,080. *J. Soc. Chem. Ind.* **42**, 1167A.

ROTARY RETORT FOR LOW-TEMPERATURE CARBONISATION.—Thyssen und Co. A.-G. Ger. Pat. 377,402. *J. Soc. Chem. Ind.* **42**, 1167A.

PREPARATION OF A TAR RICH IN MONTAN WAX FROM BITUMINOUS SUBSTANCES.—W. Mathesius. Ger. Pat. 377,353. *J. Soc. Chem. Ind.* **42**, 1213A.

MODE OF AND APPARATUS FOR THE DESTRUCTIVE DISTILLATION OF BROWN COAL, AND THE LIKE, AND SHALE AND THE RECOVERY OF VALUABLE PRODUCTS THEREFROM.—E. Box. Brit. Pat. 207,411. *J. Soc. Chem. Ind.* **43**, B46.

CONTINUOUS DRY DISTILLATION OF ORGANIC SUBSTANCES (WOOD, PEAT, LIGNITE) SUDENBERGER MASCHINENFABRIK UND EISENGIESSEREI A.-G. ZWEIGNIEDERLASSUNG VORM.—F. H. Meyer. Ger. Pat. 378,530. *J. Soc. Chem. Ind.* **42**, 1214A.

19. PITCH, ASPHALT AND BITUMEN.

COORONGITE: A MEMBER OF THE PETROLEUM FAMILY.—*Petr. World* **20**, 384. *Petr. Times* **10**, 309. *Chem. Abstr.* **17**, 3782.

ASPHALT.—P. Hubbard. *Mineral Ind.* **31**, 63. *Chem. Abstr.* **17**, 3785.

THE SOLID BITUMENS OF LEYTE.—B. Nelson. *Philippine J. Sci.* **22**, 617. *Chem. Abstr.* **17**, 3785.

THE BITUMINOUS LIMESTONES OF SYRIA CONSIDERED AS A SOURCE OF HYDROCARBONS.—Veyrier. *Chim. et Ind.* **9**, (Special No.), 420.

PETROLEUM ASPHALTS IN THE ROOFING AND WATERPROOFING INDUSTRIES.—D. Finley. *Oildom* **14**, (Oct.), 54. *Chem. Met. Eng.* **27**, 798. *Chem. Abstr.* **17**, 3916.

PROGRESS TOWARD THE UTILISATION OF THE ALBERTA OIL SANDS.—D. T. Day. *Oil Engineering and Finance* **5**, 21.

ASPHALT SPECIFICATIONS RECOMMENDED.—U.S. BUREAU OF STANDARDS SIMPLIFIED PRACTICE RECOMMENDATION 4.—*Chem. and Met. Eng.* **29**, 1189.

THE BITUMINOUS DEPOSITS OF THE LARGUE VALLEY, (FRANCE).—P. Richmond. *Chim. et Ind.* **9**, (Special No.), 411.

DEPOSIT OF BITUMEN IN A LAVA-CAVERN IN BOMBAY.—D. N. Wadia. *Proc. 7th Indian Sci., Cong.*, 135.

THE USES OF ASPHALT IN HIGHWAY CONSTRUCTION.—I. W. Patterson. *Good Roads* **65**, (Sept. 5), 73.

LINING FOR IRRIGATION CANALS.—*Standard Oil Bull. (California)* **11**, (Oct.), 6.

THE ASPHALTIC MINES OF RAGUSA.—G. Castelli. *Rass. Min. Met. Chim.* **58**, 136.

PATENTS.

BITUMINOUS COMPOSITIONS.—A. C. de Caudemberg. Brit. Pat. 198,136. *Chem. Abstr.* **17**, 3787.

COLOURED ARTIFICIAL ASPHALTUM.—D. Sanguinetti. U.S. Pat. 1,465,317.

PAINTS; BITUMEN.—D. Gardner. Brit. Pat. 195,995. *Chem. Abstr.* **17**, 3796.

BITUMINOUS MIXTURE.—D. A. Casey. U.S. Pat. 1,466,928.

21. ORIGIN OF PETROLEUM.

DIE STRATIGRAPHISCHE UND REGIONAL VERBEITUNG DER ERDÖL MIT BERUCKSICHTIGUNG DES ENTSTEHUNG DESSELBEN.—E. Pyhäla. *Petroleum* (Nov. 20). *Petr. Times* **10**, 883.

THE BEARING OF RECENT DISCOVERIES ON THE ORIGIN OF PETROLEUM.—*Petr. Times* **10**, 917.

THE GENESIS OF PETROLEUM.—L. Balliet. *Oil Age* **20**, (Nov.), 10.

A STUDY IN OIL DEPOSITS.—L. Balliet. *Oil Age* **20**, (Oct.), 10.

EXPOUNDS THEORY OF FISH ORIGIN OF OIL.—J. M. MacFarlane. *Oil and Gas J.* **22**, (21), 79.

FISH SOURCE OF OIL SAYS U.P. PROFESSOR; SUPPLY INEXHAUSTIBLE.—*Oil and Gas J.* **22**, (19), 220.

22. PHYSICAL PROPERTIES OF PETROLEUM AND ITS PRODUCTS.

THE THEORY OF EMULSIFICATION.—P. Finkle, H. D. Draper and J. H. Wildebrand. *J. Am. Chem. Soc.* **45**, 2780.

FLUIDITY ANOMALIES IN REFINED MINERAL OILS.—E. C. Bingham, W. L. Hyden and G. R. Hood. *Ind. and Eng. Chem.* **16**, 25.

PERMANENCE OF EMULSIONS FORMED BY SEA WATER AND MINERAL OILS WITH THE ADDITION OF VARYING AMOUNTS OF RAPE OIL.—L. Rosner and V. Navrat. *Petroleum* **19**, 611.

23. CHEMISTRY OF PETROLEUM.

THE LUBRICANT AND ASPHALTIC HYDROCARBONS IN PETROLEUM.—C. F. Mabery. *Ind. and Eng. Chem.* **15**, 1233.

THE PROPERTIES OF ACTIVATED CARBON WHICH DETERMINE ITS INDUSTRIAL APPLICATIONS.—N. K. Chaney, A. B. Ray and A. St. John. *Ind. and Eng. Chem.* **15**, 1244.

PREPARATION OF PETROLEUM FROM VEGETABLE OILS.—A. Mailhe. *Compt. rend.* **177**, 202. *Chem. Abstr.* **17**, 3783.

THE BEHAVIOUR OF NAPHTHENES IN THE CATALYTIC DEHYDROGENATION PROCESS. A CONTRIBUTION TO THE EXPLANATION OF THE NATURE OF CRUDE PETROLEUM.—N. Zelinski. *Ber.* **56B**, 1718. *Chem. Abstr.* **17**, 3783.

THE OXIDATION OF HYDROCARBONS WITH SPECIAL REFERENCE TO THE PRODUCTION OF FORMALDEHYDE. PART V. THE SLOW OXIDATION OF THE HIGHER LIQUID SATURATED HYDROCARBONS.—T. S. Wheeler and E. W. Blair. *J. Soc. Chem. Ind.* **42**, 491T.

HIGHER ALCOHOLS FROM PETROLEUM OLEFINS.—W. W. Clough and C. O. Johns. *Ind. and Eng. Chem.* **15**, 1030. *Oil Engineering and Finance* **5**, 44. *Chem. Abstr.* **17**, 3784.

CONTRIBUTION TO THE STUDY OF THE CHLORINATION OF METHANE.—H. Gault. *Les Matieres Grasses* **15**, 6562, 6592, 6624.

THE HIGHEST GRAVITY OIL IN THE WORLD.—*Oil Age* **20**, (Sept.), 30.

UNTERSUCHUNG GEFÄRBTER TECHNISHER WACHSKOMPOSITIONEM.—*Chem. Zeit.* **47**, 168.

TO PRODUCE ALCOHOL FROM NATURAL GAS.—*Natural Gas* **4**, (Oct.), 25.

PATENTS.

HALOGEN HYDROCARBONS.—Farbwerke vorm. Meister, Lucius und Brüning Brit. Pat. 196,272. *Chem. Abstr.* **17**, 3879.

CHLORINATING HYDROCARBONS.—C. P. Townsend. U.S. Pat. 1,468,220. *Chem. Abstr.* **17**, 3879.

WATER-SOLUBLE SULPHONIC ACIDS FROM PETROLEUM OILS AND METHOD OF PRODUCING THE SAME.—R. E. Humphreys, F. M. Rogers and O. E. Bransky, Assrs. to Standard Oil Co. (of Indiana). U.S. Pat. 1,474,933. *J. Soc. Chem. Ind.* **43**, B47. *Chem. and Met. Eng.* **29**, 1108.

PREPARATION OF DRYING OILS FROM PETROLEUM AND TAR OILS.—Badische Anilin-und Soda-Fabrik, Assees. of C. Winter. Ger. Pat. 379,530. *J. Soc. Chem. Ind.* **42**, 1186A.

24. OIL GAS AND PETROL GAS.

THE POSSIBILITIES OF OIL GAS.—T. F. Hintz. *Oil Trade J.* **14**, (12), 74.

PATENTS.

CARBURETTOR.—A. E. Batchelor. Brit. Pat. 196,313. *Chem. Abstr.* **17**, 3779.

CITY GAS FROM OIL.—E. L. Hall. U.S. Pat. 1,466,648. *Chem. Abstr.* **17**, 3779.

GENERATION OF GAS FOR LIGHTING PURPOSES.—A. E. Batchelor. Brit. Pat. 205,216. *J. Soc. Chem. Ind.* **42**, 1214A.

25. MISCELLANEOUS.

BIBLIOGRAPHY OF PETROLEUM AND ALLIED SUBSTANCES, 1921.—E. H Burroughs. *U.S. Bureau Mines Bull.* 220.

"DAS ERDÖL."—R. Kissling. Wissenschaftliche Verlagsgesellschaft, Stuttgart.

THE OIL TRUSTS AND ANGLO-AMERICAN RELATIONS.—E. H. Davenport and S. R. Cooke. Macmillan and Co., Ltd.

ARE PRESENT PRICES BASED ON GRAVITY EQUITABLE?—R. R. Irwin. *Oil Trade J.* **14**, 29.

El Petroleo.—Don Rufino Duque, Madrid.

Co-ordination of Production with Sales for Oil Companies.—E. G. Reynolds. *Manage and Administration* (Jan.), 85.

Modern Bookkeeping for Oil Producers.—G. W. Hafner. *Oil and Gas. J.* **22**, (17), 62.

Mining for Ichthyol.—*Oil Age* **20** (Nov.), 28.

Fuller's Earth.—D. M. Phillips. *Texaco Star* **10**, (Oct.), 5.

Hydrogen Sulphide as an Industrial Poison.—R. R. Sayres, C. E. Mitchell and W. P. Yant. *U.S. Bureau of Mines Repts. of Investigations* 2491.

Oil Company has Scheme for Daily Inventory.—G. Triplett. *Oil Weekly* **30**, (13), 21.

Japanese Seeking Petroleum from Fish Getting Gasoline.—*Oil and Gas J.* **22**, (9), 80.

Chief Problems Facing the Oil Industry.—N. O. Fanning. *Oil and Gas J.* **22**, (20), 34.

Keeping Oil Asset and Expense Accounts.—G. W. Hafner. *Oil and Gas J.* **22**, (18), 56.

Proposed Uniform Terminology for Petroleum and Petroleum Products, Bitumens, Asphalts and Tarry Products.—*Chim. et Ind.* **9**, 837.

Abstracts.

Compiled by S. Bowman, F.I.C., R. W. L. Clarke, P. Dvorkowitz, Ph.D., F. G. P. Remfry, B.A., D.Sc., A.I.C., and T. A. Smith, B.Sc., F.I.C.

General.

The Separation of the Components of Petroleum.—P. F. Gordon. *J. Soc. Chem. Ind.* 42, 42, p. 405–414 T.

The paper, which promises to be the forerunner of others of considerable interest, is divided into four main parts; the first deals with Industrial Processes as carried out in works under works conditions, the second with Physical Conditions and Fractional Precipitation, the third with Surface Tension, and the fourth in conjunction with C. C. Middleton, is a preliminary communication dealing with the preparation of pure hydrocarbons.

Part I. Industrial Processes.—Burma crude oil was refined by works procedure and a chart showing the modus operandi is given. This shows the author to have made use of three sets of continuous stills for crude oil, benzine, and kerosene distillations; Coking stills for heavy crude residuum, and intermittent stills for redistillation of heavy distillate. Hot condensers of the "fractionating" type were also employed. A second chart outlines in detail the "Separation of Wax" from the H.O. & P., showing the many paths that are traversed by the several fractions as they enter, pass through, re-enter and finally leave the process.

The author has adopted several modifications of old-time methods and plant to suit his particular purpose, and has effected an improvement in the application of the Winterstein process, the result of which increases the yield of wax from 6·85 to 7·75 per cent. on the crude oil. He is thus led to disagree with Campbell and Wilson (*Journ. Inst. Petr. Techn.*, **5**, 18, Feb. 1919) that the present process of wax separation is efficient. In using Thompson's coolers for H.O. & P., brine is preferred to liquid ammonia, owing to the more even cooling. Acid treatment of the third stage blue oil is effected by 1 per cent. C.O.V. used in three stages, followed by soda and water washing, claiming thereby a better result with less expenditure of acid. For the final decolorisation of white wax animal charcoal ("ferrocyanide char") was found superior to vegetable char, but the latter is improved by treatment with zinc chloride and subsequent washing and drying.

A wax recovery plant is which the spent charcoal is subjected to treatment with the superheated vapour of benzine is described and is claimed to give efficiency in working.

Part II. (*a*) *Physical Conditions.*—Attempts to extract the solid paraffins from crude oil by direct refrigeration and filtration under

pressure, or by centrifuging, only produced an amorphous pasty mass which could not be freed from the oil adhering to it. Subjecting Hardstoft crude, however, to dialysis with ether, the author succeeded in extracting white flakes of wax after evaporation of the solvent, and is of the opinion that wax is originally present in crude oil in a condition that is altered to the crystalline form by distillation. Optical examination of several crudes showed the Tyndall cone, and it is suggested that this phenomenon may be due to the colloidal or emulsoid condition of associated higher hydrocarbons and other components having complex molecules in a dispersion medium of lower hydrocarbons. This physical condition may be disturbed by solvents such as ether and also by distillation, thus making possible the removal of wax.

(*b*) *Fractional Precipitation.*—Having regard to this action of ether, Gordon fractionated Hardstoft crude oil by dissolving in ether and precipitating with several successive additions of 90 per cent. alcohol, and finally with acidulated water. Examination of the fractions obtained led him to conclude that the wax is present in the crystalline state in the crude oil, but is surrounded by a protective colloid which hinders the formation of crystalline aggregates. An interesting fact is shown in the iodine values of all these fractions being low (2–3 per cent.) and approximately equal, and it is suggested that the unsaturation usually associated with this crude may be the effect of the high temperature employed during distillation. A table showing the physical constants of these fractions is given.

Part III. Surface Tension.—Experiments were carried out to ascertain whether emulsification could be employed as a means of separation of the various components. These showed that partial emulsification with water and the production of a froth with soap solution effects a certain degree of separation, the non-emulsified oil being lower in specific gravity and the emulsified oil and oil removed as froth higher in specific gravity than the original oil.

Interfacial tension measurements were made by the drop method and confirmed the view expressed that a solution of one or more higher hydrocarbons in lower ones lowers the surface tension of the latter and so displaces them from surface layers, both in a froth and when surrounding globules of certain liquids suspended in the hydrocarbon mixture.

Experiment shows that with dilute solutions of wax in kerosene the interfacial tension oil-water varies inversely with the concentration; and the measurement of this (the drop number) gives a more delicate test of continuity than does specific gravity (as determined by the Westphal balance).

Hardstoft crude oil was fractionated by steam distillation into fractions of gradually increasing specific gravity, and the interfacial tension between each fraction and water was determined and the effect of the addition of a higher fraction to a lower one noted. Results are tabulated.

Part IV. Preliminary Communication.—This section deals with the efforts of the authors to prepare pure hydrocarbons to be used for their further work on surface tension. A review of the various known methods is given, and after consideration Herzfelder's bromination method was adopted. A light cut was made from Persian crude oil by distillation with steam up to 100° C., and this refractionated without steam up to

135° C. into small fractions. Fractions 60° to 80° C., and 80° C. to 105° C. were brominated, and the derivatives re-crystallised when possible, and the following results obtained :—

Fraction 60°–80°C.	(*a*)	Colourless needles	M.P. 200°C. (decomposes).
	(*b*)	„ plates	M.P. above 270°C.
	(*c*)	„ liquid	B.P. 80°–105°C.
	(*d*)	„ „	B.P. 100°–120°C.
80°–105°C.	(*a*)	„ needles	$C_9H_{12}Br_6$ M.P. 266°C.
	(*b*)	„ „	$C_7H_{11}Br_5$ M.P. above 270°C.
	(*c*)	„ liquid similar to (*d*) above.	

Further work is in progress. S. B.

Petroleum Evaporation Losses.—*Chem. Met. Eng.*, 1924, **30**. No. 2, 55.

Investigations by the U.S. Bureau of Mines have shown that the enormous losses of petroleum when stored on the producing property can be effectively reduced by the use of gas-tight storage tanks. Under present average conditions in the Mid-Continent field 6·5 per cent. of the total oil produced is lost by evaporation, 3·5 per cent. occurring on the field and 3 per cent. in transit. A loss as high as 9·3 per cent. in less than ten days has been observed. The average lapse of time between well and refinery is 5·1 months, and for some methods of handling the evaporation losses amount of 12–15 per cent. of the crude produced at the well before it enters the stills. With crude oil at 2 dollars per barrel, it is estimated that the oil saved by making tanks gas-tight will pay for the installation in 30–90 days. The non-adoption of preventive measures is due to failure of managers to realise that their evaporation losses are enormous, and that they can be eliminated at a small cost. It is believed that in the future the following installation will be in practice :—

(1) Gas traps for separating permanent gas from oil at pressures above atmospheric. (2) Really tight flow or separating tanks, and (3) tight stock tanks. Methods for reducing pipe-line losses must also be devised. Technical paper 319, by J. H. Wiggins, describes in detail certain up-to-date practices for decreasing losses, including evaporation of gasoline and its recovery, differences in loss from tanks differing in tightness, the economy of replacing old leaky roofs, the effect of passing fresh oil through a high vacuum tank and tests to determine pipe-line losses.

F. G. P. R.

Use of Aluminium to Prevent Steel Corrosion.—A. V. Farr. *Chem. Met. Eng.*, 1923, **29**, No. 27, 1188–9.

The ability of aluminium to resist corrosion has been known, but its use as tubes has been limited. Calorised steel tubes combine strength with the corrosion resistance of aluminium, and the fact that they also resist the action of heat is bringing them largely into use. The process of calorising consists in heating the object in a rotary retort in a reducing atmosphere of high temperature, the retort being filled with a mixture containing finely divided aluminium. The treatment infuses aluminium into the exposed portion of the metal to form a homogeneous alloy. The electrolytic theory of corrosion explains the protective action of the aluminium coating, the local impurities in the steel being covered up and protected. The oil refining industry was the first to employ calorised tubes, these being unaffected by sulphuretted hydrogen, sulphur dioxide,

sulphur vapour, carbon monoxide, and the furnace gases and vapours usually found in refining practice. Various metals suspended in the upper drum of a pressure cracking still running Mid-Continent crude for four months lost in lb. per sq. ft. of exposed surface as follows:—Calorised steel, 0·013 and 0·004; steel plate, 0·502 and 0·390; tank steel, 0·412; bronze alloy, 0·056. Calorised tubes can be bent to any shape and so can be employed in any form of pipe-line. Comparative tests between calorised steel plates and untreated steel exposed for a period of two years to the fumes of a laboratory and to the atmosphere of a damp cellar proved greatly to the advantage of the former with regard to corrosion. A similar test for ten months out of doors gave like results. F. G. P. R.

Mining and Treatment of Oil Sands.—G. Schneider, *Petroleum*, Nov. 1, 1923.

Experience at Pechelbronn shows that 10 per cent. of the oil content of the oil sand is obtained by ordinary drilling methods and 45 per cent. by the tunnelling method. The residual oil can be separated by washing the excavated sand with hot water. This has been carried out in vats agitated by hand, and it has been found that when the water reached 70°C. the removal of oil was complete and practically instantaneous. The author suggests that oilfields that have ceased to yield in the ordinary manner could be attacked by means of water jets to remove the oil retained by adhesion and capillarity. The suggested procedure with an oilfield is (1) drilling in the ordinary manner to obtain freely flowing oil and exhaust the gas pressure; (2) drainage of the sands by driving parallel tunnels in the oil stratum; (3) hydraulic disintegration to recover the residual oil. The method is applicable where, owing to high viscosity and low pressure, the ordinary methods of oil recovery are impracticable. T. A. S.

Contact Polymerisation of Acetylene.—N. D. Zelinski, *Compt. Rend.*, 1923, 177, 882–5.

When acetylene is passed through a tube, packed with activated wood charcoal and maintained at 640–650°C., 70–80 per cent. of the gas is converted into a tar, of which 45 per cent. boils at 20–150°C., 13·9 per cent. boils at 150–250° C., 29 per cent. at 104–300°C. at 13 mm., and 12 per cent. remains as residue. About 35 per cent. of the tar can be separated as pure benzene. Toluene, xylene, styrene and indene may also be isolated and naphthalene, fluorene and anthracene may be isolated after repeated re-crystallisations. T. A. S.

Oxidation of Hydrocarbons to Formaldehyde.—R. Schönfelder, *Ber. Ges. Kohlentechnik*, 1923 (IV.), 247–263.

On passing methane, mixed with steam and air, over copper or silver heated to 500°C., 55–58 per cent. is converted into formaldehyde, 25–40 per cent. is unattacked, and 10–20 per cent. is burnt to carbon monoxide and carbon dioxide and water. By the use of catalysts or activated carbon a certain amount of formaldehyde can always be obtained from methane and air. Unsaturated gaseous hydrocarbons give better yields. T. A. S.

Sulpho-Compound and its Production.—E. M. Johansen, Assr. to The Atlantic Refining Co. U.S.P. 1,477,829. December 18, 1923. Application January 25, 1921.

Non-oily crystalline or crystallisable bodies, obtained from the high boiling distillate produced in the destructive distillation of mineral oil are sulphonated. T. A. S.

RECLAIMING OF THE BIBI-EIBAT BAY.—*Russ. Min. Journ.*, N.10.

The Soviet Government has now placed a contract with the Caspian Steamship Company to reclaim nearly 600 acres of the Bay in the course of the next 5½ years. The work is to be finished in 1929. Unquestionably this will have a most important effect on the increased production of crude in Baku district. Some of the borings which have been made on the previously reclaimed portions of the Bay have already proved to be very prolific. P. D.

BENZINE-GAS.—S. Stryjou, *Russ. Min. Journ.*, N.10, p. 525.

Under the above heading the author gives statistical data of the production of crude oil, motor spirit and other products in the U.S.A., as follows :—

Quantity in Million Gallons.

Year.	Benzine.	Kerosene.	Fuel Oil.	Lubricating Oil.
1914 ..	1500 ..	1935 ..	3734 ..	517
1916 ..	2059 ..	1455 ..	4664 ..	625
1917 ..	2851 ..	1727 ..	6513 ..	754
1918 ..	3570 ..	1825 ..	7321 ..	841
1919 ..	3958 ..	2342 ..	7627 ..	847
1920 ..	4883 ..	2320 ..	8861 ..	1017
1921 ..	5154 ..	1945 ..	664 ..	878
1922 ..	6202 ..	2330 ..	10,635 ..	980

From the above table it is evident that the whole policy of treating crude oil has entirely changed; whereas in 1914 the production of motor spirit in America was, by 400,000,000 gallons, less than the production of kerosene, in 1922 the production of benzine was 4,000,000,000 gallons above that of kerosene. About ten or fifteen years ago the refineries produced more kerosene than benzine.

The rapid output of such enormous quantities of benzine is due to the fact that while there were only about two million cars in use in 1912 in the United States, in 1922 12½ million motor-cars and lorries were on the roads.

The sum spent on additional automobiles and lorries amounts to about 1,500,000,000 dollars.

Foremost amongst American industries stands the meat trade; the next is the steel trade, and the automobile trade ranks third, in which 2,431,400 workmen are employed.

Mr. Stryjou, in reviewing the development of the motor spirit trade, comes to the conclusion that America will not be able to export sufficient motor spirit to Europe. He thinks that in future Europe will depend on the Grozni district for all its motor spirit. He believes that Grozni can supply 30,000,000 poods of benzine per annum. In addition, a considerable amount of gasoline can be extracted from the Grozni natural gas, the sp. gr. of which is 1·75, and this practically represents benzine vapours, and about 12 gallons of benzine can be extracted from 1000 cu. ft. of gas—*i.e.*, one well in the Grozni district gives 3000 poods of benzine per day from its gas alone.

It has already been decided that a benzine extraction plant (from gas) should be put up in Grozni. P. D.

PRODUCTION OF CRUDE FOR APRIL–JUNE 31ST, 1923.—*Russ. Min. Journ.*, N.10, p. 5.

I.

(1) Baku	55,477,900	poods.
(2) Grozni	21,922,200	„
(3) Emba	2,060,000	„
(4) Kuban district	843,400	„
Total	80,303,500	poods.
Used as Fuel	8,685,900	„
Net production	71,617,600	poods.

Of the above quantity 12,498,400 was received from spouting wells.

II. The number of wells in exploitation—5514.

III. Number of feet bored—70,000.

IV. A new spouter in Grozni at 2,575 feet deep gives a daily output of 100,000 poods of paraffinous crude.

V. The Baku production for three months ending September was 57,248,000 poods. For twelve months ending September the total was 213,000,000 poods, or 35,000,000 poods more than in the previous year.

VI. Boring for the year—154,731 feet.

Number of wells exploited—1562,

which consisted of:—

Bailers	1422
Compressors	123
Spouters	17

P. D.

DISTILLATION AND REFINING.

EFFECT OF COOLING SYSTEMS ON EVAPORATION LOSSES OF GASOLINE.—L. Schmidt. *Nat. Petr. News*, 1923, 15, No. 42, 51–7.

The U.S. Bureau of Mines has conducted tests on the effect of water sprays, water seal roofs and insulation on tanks for reducing evaporation losses. Losses due to evaporation of gasoline when stored in tanks are twofold—(*a*) loss of bulk, and (*b*) loss of the lightest constituents. The first loss is easily remedied and is not very costly, but the second is a serious matter to the producer, as the addition of light constituents to bring the initial boiling point and specific gravity back to normal is an expensive undertaking. Four main factors govern the rate of evaporation of liquids—(1) renewal of air over the evaporating surface, (2) the temperature of the surface of the liquid, (3) the area of the evaporating surface, and (4) the quantity of vapour in the supernatant atmosphere. The tests carried out aimed at control of factors (1) and (2). The first necessity is vapour-tight tankage, in order that there may be no renewal of air over the surface of the liquid except as may be caused by temperature changes (*i.e.*, breathing), and by emptying and filling a tank. Vacuum and pressure release valves should be fitted that work at pressures of 1 and 1½ ounces respectively. This does not eliminate

but reduces losses by breathing to a minimum. Even so, losses are considerable. A 55,000 barrel tank 30 ft. high and filled to 29 ft. has a vapour space above the oil of 34,330 cu. ft. If the temperature increased 40°F., 2800 cu. ft. of gasoline saturated air would be expelled. If the tank were filled to 15 ft. the saturated air expelled would be 14,500 cu. ft. In hot summer weather the vapour often contains 80 per cent. of gasoline vapours, and assuming 30 cu. ft. of vapour per gallon, the losses would be about 93 gallons. Frequent minor changes of temperature, barometric changes, wind pressure and other atmospheric changes all produce losses which may double those due to one large change of temperature. Comparative tests were run between three 250 barrel vapour-tight tanks, one having a revolving water spray to cool the roof and sides, the second having a water-seal roof, and the third being entirely uncooled. The results proved that the water spray system was in general the most efficient in preventing losses, as it was capable of maintaining a lower average temperature both in the liquid and vapour than the other systems. The daily average variation, however, between high and low temperatures was less in the water sealed tank than in the sprayed tank, but this was not sufficient to bring the former into first place for all-round efficiency. In 35 days the losses by evaporation with the three systems—spray, seal and no cooling—were 0·65 per cent., 0·9 per cent., and 1·54 per cent., whilst the gravity loss in degrees A.P.I. were 0·2, 0·3, and 0·6 respectively. In another test a tank with water sealed roof was compared with an ordinary tank which was neither cooled or vapour tight. By accident a vapour line from the water sealed tank was left open, and the evaporation losses from the two tanks were very close, thus proving that water cooling is of little use unless the tanks are at the same time vapour tight. Comparisons were also made between water cooled tanks and insulated tanks. It is considered that insulation is of little use unless an air space is left between the tank and the insulation, by which means a cooling draught can be induced to flow over the tank at night by opening dampers. Much greater efficiency can be obtained by combining insulation of this type with a water spray, though this increases the cost. In all cases, however, the point of primary importance is to see that tanks are kept vapour tight and only allowed to breathe through their release valves. F. G. P. R.

GETTING THE MOST OUT OF MEXICAN CRUDE.—F. N. Williams, Refiner and Natural Gasoline Manufacturer. 1924. 3, No. 1, 7–14. (Part I.).

The author describes the crude, the methods of refining, apparatus used, yields, products obtained, description of products and use of pressure stills to increase the yield of gasoline. Many tables are given throughout the article, including a chart of a complete refining scheme with all treatments, losses, yields, gravities, colours, flash points, etc. Mexican crude is described "as a high-class paraffin base crude containing a large percentage of asphalt and considerable sulphur, or as asphalt base crude containing paraffin in sufficient quantity to make it quite hard for the refiner to follow either method of refining—*i.e.*, considering it either as asphalt or paraffin base crude." The oil should first be passed through pipe stills to get rid of the considerable amount of water usually present, and should leave with a temperature of 450°F. It is then passed through a separator, where the naphtha vapours are removed and redistilled with steam. The topped crude is subjected to a cracking distillation in 1000-barrel stills equipped with towers and

split into gas oil distillate, gas oil test, paraffin distillate and heavy ends, with coke remaining in stills. The gas oil distillate and paraffin distillate are topped to remove cracked naphtha which is redistilled for gasoline. The paraffin distillate is acid treated, pressed, and re-run for lubricating oils. Defects in the distillations are pointed out by the author and remedies suggested. By distilling the lubricating oils over soda a better colour and reduced sulphur are obtained than without the soda, and the oils do not break down as readily on heating and can be acid treated without fear of emulsification. A considerable amount of gas, of density 0·903 compared with air, is given off when the gas oil and paraffin distillate come over, which must be taken off by a slight vacuum to storage for use as fuel. It is very toxic, contains a lot of sulphur, and is highly unsaturated. On account of the larger amounts of naphtheres, aromatics, olefines, di-olefines and sulphur and nitrogen compounds in Mexican oils they present quite different problems to Mid-Continent oils in refining. F. G. P. R.

Making Evaporation an Ally.—C. P. Buck. *Petroleum Age*, 1924, **13**, No. 2, 23–4.

An open crude oil tank is virtually a wasteful topping still, therefore a pressure tank can be converted into an economical natural topping still wherein the light fractions that cause loss at later stages of handling can be removed and recovered for use in natural gasoline manufacture. In order to remove the natural "wild gas" from oil as it comes from the well the usual practice is to pass it first through a constant level flow tank, where water and sediment settle out and the gas is given off. To allow this to take place quietly the oil on entering is deflected circumferentially around the inner surface of the tank in a thin sheet, thus exposing the greatest area to evaporation. From the flow tank the oil passes by a gravity line to a battery of from three to a dozen or more stock tanks, and thence to the pipe lines. Natural fixed gas, mostly methane and ethane, is given off in the flow tank, but the vapour above the oil in the stock tanks is composed of higher members of the series, which are condensable and form the most valuable portion of motor gasoline. If these tanks are open and allow air to enter and vapour to escape enormous losses occur as the tanks are emptied and filled, the magnitude of which is shown by taking the average of many observations in the principle Mid-Continent fields. With open tanks an average of 100 barrels per month of gravity 37·12°Bé is run to pipe line, whilst from pressure tanks the average is 116 barrels of 41·4°Bé gravity. The loss is thus 13·8 per cent. of spirit having a calculated gravity of 74·68°Bé. The pressure carried on the tanks should equal that of the vapour pressure of the condensable gases, whereby condensation at the surface of the oil is promoted. A better system, however, is to remove all vapours from the surface of the oil as it forms and pass it to a vapour recovery plant. To do this the vapour spaces of the stock tanks are all connected by a line to the vapour space of the flow tank into which dips a vacuum line so adjusted as to take the vapours from just above the constant-level surface of the oil, where the richer and heavier vapours collect. As the roof of the ordinary gas-tight 250-barrel tank will scarcely stand a vacuum of two inches of water a stronger design is recommended, but the vacuum breaker and release valves must be very sensitive and act quickly. With tanks so equipped the whole of the 74°Bé gasoline that was formerly lost can be collected, and a recovery of from 6–10 per cent. of the production treated can be made by these

means. It is considered that it would be profitable to apply the vacuum system to every gathering tank, relay tank, and even to oil in storage at the refinery as well as on the fields. F. G. P. R.

ACID AND FULLER'S EARTH TREATMENT OF CALIFORNIAN CRACKED DISTILLATES.—G. Egloff and J. C. Morrell. *Oil Age*, 1923, **20**, No. 5, 27–8.

On account of the presence of nitrogen compounds of the pyridine and quinoline type, as well as sulphur and phenolic bodies, Californian oils are more difficult to refine than Mid-Continent crudes, and for the same reason cracked distillates from the former offer more serious difficulties to the refiner than from the latter. The authors describe a method of refining wherein the oil is treated with sulphuric acid, neutralised by filtering through fuller's earth and distilled. Californian gas oil was cracked at a temperature of 840–60°F. under a pressure of 120 lb. per sq. in., and the distillate of 49–50°Bé gravity treated in two portions with 66°Bé sulphuric acid. The amount of acid used was 2, 4 and 6 lb. per barrel (42 gallons), but the authors do not state which gave the best results, all the final products being described as equally good. Acid treatment did not alter the colour appreciably, but on filtering through fuller's earth at the rate of 3 lb. of earth to a gallon of oil to be filtered the colour was changed from dark red to a light yellow. On distilling the filtrate with steam to a final boiling point of 435°F. a water-white, sweet-smelling gasoline was obtained which was negative to the "Doctor" test, and had a gravity of 55°Bé. During the refining by acid and fuller's earth the gravity of the original distillate dropped 0·5 to 1·2°Bé, according to the treatment.

F. G. P. R.

TO DETERMINE OIL-REFINING PRACTICE.—*Chem. Met. Eng.*, 1924, **30**, No. 1, 16.

The U.S. Bureau of Mines have instituted an investigation of refining methods to determine what fundamental principles should be applied to obtain a maximum yield of gasoline and kerosene from crude oil. The work has been divided into three general parts—(1) a study of theoretical problems and development of fundamental considerations relative to fractional distillation; (2) tests in refineries to substantiate the theories involved; and (3) tests in a small specially constructed refining unit for the purpose of developing new methods of running. Several tests have already been run in refineries. F. G. P. R.

DEHYDRATOR.—W. Meredith, Assr. to Petroleum Rectifying Co. U.S.P. 1,480,091 of Jan. 8, 1924. (Appl. Feb. 14, 1921.)

The water particles in an emulsion are agglomerated by forcing the emulsion upwardly in a series of fine jets through a loosely held mass of comminuted material. T. A. S.

PROCESS OF PURIFYING MINERAL OILS.—A. Railland. E.P. 193,029 of Jan. 1, 1923. Conv. (France) Feb. 7, 1922.

Mineral oil is stirred with a quantity of water. Sulphuric acid of 66°Bé, or fuming sulphuric acid, is added with further stirring, and after settling the oil is passed through a centrifuge. It is then washed with alkali. The quantity of water and acid used depends on the nature and quantity of impurity present in the oil and is determined by experiment. T. A. S.

EVAPORATION PREVENTING MANTLE.—A. B. Davis. U.S.P. 1,479,790 of Jan. 8, 1922. (Appl. May 19, 1923.)

The foam mantle for the purpose described consists of a blown mixture of a starch sugar, a hygroscopic salt and a glycol. T. A. S.

ELECTRICAL DEHYDRATOR.—F. W. Harris. U.S.P. 1,480,064 of Jan. 8, 1924. (Appl. May 9, 1923.)

An electrostatic field is established between charged surfaces immersed in an insulating fluid of sufficient dielectric strength to prevent disruptive charges. The emulsion to be dehydrated is passed through the field in such a manner that the insulating fluid around one of the electrodes is unbroken and the dielectric strength is maintained sufficiently high to prevent disruptive discharge. T. A. S.

DISTILLING MATERIALS IN CONTACT WITH POROUS MATERIALS.—B. Gallsworthy, Assr. to The Texas Co. U.S.P. 1,477,642 of Dec. 18, 1923. (Appl. Nov. 7, 1919.)

Oil-emulsions are sprayed on to heated lignite maintained at such a temperature that the water is distilled off whilst the oil percolates through. T. A. S.

IMPROVEMENTS IN PURIFICATION OF OILS.—R. D. Masson & H. Engel. E.P. 207,660.

Oil is passed down a vertical column fitted with devices to insure that the oil comes in good contact with ascending superheated steam. The apparatus is maintained under reduced pressure, the lowest point of the oil supply pipe being at a greater vertical distance from the oil outlet of the still than the length of a barometric column of hot oil. Heat interchangers are provided for the transference of heat from the oil which has been heated to the ingoing oil. After cooling, the heated oil is passed through a filter press. T. A. S.

IMPROVED OIL DISTILLATION APPARATUS.—The Power Speciality Co. (Comm. to T. E. Robertson). E.P. 207,041 of Nov. 23, 1922.

Oil contained in a horizontal still is heated by waste heat from a furnace. From the still oil is pumped through a nest of tubes, which receive the direct heat of the furnace, back to the bottom of the still, the contents of which are thus heated. Vapours from the still are taken through heat interchangers, where they preheat incoming oil, and thence to a condenser. Superheated steam may be introduced into the heated tubes when necessary. T. A. S.

MOTOR FUELS.

PRODUCTION OF LIQUID FUEL MIXTURES CONTAINING ALCOHOL.—P. Loriotte. E.P. 188,336 of Nov. 3, 1922. Conv. (France) Nov. 3, 1921.

The tendency of liquid fuel mixtures containing alcohol to separate into two layers at low temperatures is due to the water content of the commercial alcohol used, which is rarely less than 5 per cent. Anhydrous alcohol is obtained by passing alcohol vapours over drying agents such as quicklime, calcium, potassium carbonate or calcium carbide. Fuel mixtures prepared with this alcohol remain homogeneous at very low temperatures. T. A. S.

IMPROVEMENTS IN AND RELATING TO FUELS FOR INTERNAL-COMBUSTION ENGINES.—T. Midgley, junr., Assr. to General Motor Research Corporation. E.P. 196,237 of June 23, 1922. Conv. (U.S.A.) April 15, 1922.

The tendency of fuels to "knock" in high-compression engines is overcome by the addition of tetra-ethyl lead or a vapourisable compound of a metallic element in a group between the third and seventh groups of Mendeleef's table. A very small proportion of the compound (1 part in 2000 in the case of tetra-ethyl lead) is sufficient to make a gaseous fuel withstand very high compressions. Phenyl or alkyl compounds of the metal may be used. The increases observed the critical compression ratios are in the case of tin 15 lb., and in the case of lead 340 lb, when 1 per cent. of the metallic compound is added to the fuel.

T. A. S.

MOTOR SPIRIT.—J. Diamond. E.P. 207,883 of Sept. 7, 1922.

An alcohol-fuel, containing a liquid alkaloid and having a decreased tendency to corrode the material of cylinders and pistons, is prepared by mixing 100 gals. 95 per cent. alcohol, 80 gals. ether, 25 gals. benzol, and 2 ozs. nicotine. The mixture is partially dehydrated by distilling over lime.

T. A. S.

A NEW OR IMPROVED MOTOR SPIRIT FOR USE IN INTERNAL-COMBUSTION ENGINES.—J. W. Alexander. E.P. 209,453 of Sept. 8, 1922.

Graphite, sufficiently finely divided to remain in suspension, is added to any ordinary motor spirit or mixture to the extent of 0·05–0·1 lb. per gallon. The graphite provides lubrication for valve spindles, etc., and acts as a decarboniser. A considerably greater mileage per gallon is obtained.

T. A. S.

IMPROVED MANUFACTURE OF LIQUID FUEL.—C. P. Byrnes. E.P. 209,128 of Aug. 1, 1922.

Liquid hydrocarbons—*e.g.*, kerosene or heavier fractions—are vapourised mixed with air and passed over catalysts. Suitable catalysts are oxides of vanadium, molybdenum or uranium. The oxides are supported in layers on screens, and part of the necessary air is admitted between the screens. The partially oxidised product is condensed and consists of alcohols, aldehydes and aldehyde acids. The portion of the condensate distilling below 200° forms a very desirable engine fuel. The higher fractions are again put through the oxidising apparatus together with fresh oil, a further yield of motor spirit being obtained. As the process is continued the heavier fractions, consisting of organic acids, tend to accumulate; but if the product is distilled over basic oxides these acids are decomposed, making it possible to get a continuous satisfactory yield of light material. The basic oxide, magnesium oxide, is suspended on a screen about 4 ins. above the bottom of the vapouriser. The oxidising screens operate at 340–350°. From Pennsylvania, boiling between 200–300° a yield of 23 per cent. of material boiling below 200° was obtained.

T. A. S.

LIQUID FUEL.—L. du P. Clement, Assr. to Kent County Oil Corporation, U.S.P. 1,475,259 of Nov. 27, 1923. (Appl. May 24, 1921.)

A homogeneous colourless liquid fuel having a flash point of 196° F. is made by agitating toluol, kerosene, and naphtha with an aqueous

solution of aluminium sulphate. The toluol content is twice the kerosene content, and the fuel is suitable for internal-combustion engines. T. A. S.

PRODUCTION OF LIQUID MOTOR FUELS.—K. Kelley, Assr. to T. L. Kerr. U.S.P. 1,480,808 of Jan. 15, 1924. (Appl. Aug. 15, 1921.)

Casing-head gasoline is distilled, the vapours being mixed with those obtained in the fractionation of kerosene. The mixed vapours are condensed. T. A. S.

PROCESS OF MANUFACTURING LIQUID FUEL.—J. Black, U.S.P. 1,480,368 of Jan. 8, 1924. (Appl. Sept. 27, 1923.)

A mixture of crude petroleum and untreated coal oil is distilled in the presence of a mixture consisting of acetone benzol, soda and alcohol. Acetone is present to the extent of 2 per cent., benzol 2 per cent., soda 1.25 per cent., and alcohol 0.5 per cent. of the volume of the petroleum. Distillation starts at 40° and is carried on to 215°, whereby a spirit of end point 225° is obtained. T. A. S.

FUEL AND PROCESS OF PRODUCTION.—E. A. Charbonneaux. U.S.P. 1,480,372 of Jan. 8, 1924. (Appl. Dec. 20, 1920.)

Crude oil containing nitratable ingredients is treated with nitric acid. The nitrated product is separated and mixed with a suitable proportion of alcohol. T. A. S.

CRACKING.

THE CRACKING OF CRUDE OIL.—*Russ. Min. Journ.*, N.10.

The Council of Petroleum Industry has organised in Moscow experiments of cracking crude oil by a system of Mr. V. G. Shukow, under the supervision of the Chief of the refinery section, Mr. I. I. Yelin. The project includes a practical cracking plant for kerosene and solar oil, and it will be known as Shukow's system. P. D.

IMPROVEMENTS IN PROCESSES FOR TRANSFORMING HYDROCARBON LIQUIDS INTO LIQUIDS OF LOWER BOILING POINT.—S. J. M. Auld. E.P. 208,569 of July 20, 1922.

The vapour of high boiling hydrocarbons is passed over absorbent material such as activated charcoal, silica gel or ferric hydroxide gel heated to 400–700° C. The operation is carried out under a pressure of 10–50 lb. per sq. in. A light gas oil of initial boiling point 210°, and a final boiling point of 275° gave a 70 per cent. yield of petrol of initial boiling point 40° and final boiling point 200°, when the vapour was passed under a pressure of 30lb. per sq. in. through activated cocoanut shell charcoal maintained at 520-540°. The petrol was white in colour, similar in odour to natural petrol, and did not deposit polymerised gum-like material on standing for a long period. The adsorbent material used must have a high adsorbent capacity, 10 gr. of the material being capable of adsorbing 1 c.c. of liquid benzene as vapour from air. T. A. S.

PROCESS AND APPARATUS FOR CRACKING OILS. J. F. Monmot. E.P. 208,310 of Oct. 27, 1922.

The apparatus consists of two concentric spheres, the inner containing balls of refractory material such as fireclay. Round the outer

surface of the inner sphere are wound copper coils. The oil to be treated is forced at a pressure of 50–75 lb. through the copper coil, which is heated by passing exhaust gases through the space between the spheres or by other suitable means. It is then expanded through a jet and passed, with a little air, over the refractory material contained in the inner sphere, which is maintained at 500°C. The cracked vapours and finely divided oil are carried forward, either to be used direct in an internal-combustion engine, or to storage. T. A. S.

PRODUCTION OF LOW-BOILING HYDROCARBONS FROM THOSE OF HIGHER BOILING POINT.—U.S. Gasoline Manufacturing Corpn. (Comm. to A. E. Alexander). E.P. 207,276 of Aug. 28, 1923.

Cracking is brought about by heating hydrocarbon oil in a gradual manner so that violent disruption of the molecule, with consequent formation of carbon and permanent gas is avoided. The operation is carried out at predetermined pressures, which are maintained by means of a compressor. Heat is conveyed to the oil to be cracked by heated vapours which have already been through the cracking cycle, or heated casing head gas, so that direct heating of liquid hydrocarbon does not take place. The hot vapours produce some cracking of the oil and carry away the light products. After passing through heat interchangers the vapours are sprayed with a little water to remove heavy fractions, and then passed through a condenser. Uncondensed gases are passed through an oil scrubber to remove petrol, and after passing through the heating coils are again brought in contact with the cracking stock. T. A. S.

DISTILLATION WITH CATALYSTS FOR PRODUCTION OF LOW BOILING FROM HIGH BOILING OILS.—G. L. Prichard & H. Henderson, Assrs. to Gulf Refining Co. U.S.P. 1,476,219 of Dec. 4, 1923. (Appl. Nov. 21, 1921.)

A mixture of high boiling oil and aluminium chloride is maintained at a constant temperature such that free ebullition occurs. The mixture is agitated and the temperature is maintained by continuously removing a portion of the contents of the still, passing it through a heating element, and returning it to the still. The vapours of low boiling oils are continuously removed and condensed. T. A. S.

PROCESS OF AND APPARATUS FOR MANUFACTURING LOW BOILING FROM HIGH BOILING HYDROCARBONS.—A. M. McAfee, Assr. to Gulf Refining Co. U.S.P. 1,476,091 of Dec. 4, 1923. (Appl. Dec. 15, 1919.)

During the distillation of hydrocarbon oils with aluminium chloride the gummy mass formed is kneaded until it becomes too brittle for this operation, after which it is ground. The still is fitted with a lifting device for lifting steel balls and also with stirring gear. T. A. S.

APPARATUS FOR THE CONVERSION OF OILS.—J. H. Adams, Assr. to the Texas Co. U.S.P. 1,477,860 of Dec. 18, 1923. (Appl. April 6, 1916.)

Oil from a supply tank is passed to a still, the vapours from which are pumped through a tubular converter maintained at high temperature. After separation of carbon and liquid products in a trap the cracked vapours are passed to a condenser where condensation takes place under pressure. T. A. S.

HEAT TREATMENT OF HEAVY OILS.—Standard Development Co. U.S.P. 1,478,102 of Dec., 1923.

The invention relates particularly to the heat treatment of heavy oils of high viscosity, which may not efficiently be used as fuel, in order to break down their viscosity. The process consists of preheating the oil to a point below cracking temperature. A small quantity of steam is injected into the preheated oil, and the mixture maintained at a pressure substantially sufficient to keep it in the liquid phase, passes through a coil, consisting of a plurality of straight pipes set in a suitable furnace. There it is raised to conversion temperature (370·440°C.) for a period insufficient to cause the formation of substantial amounts of low boiling hydrocarbons. The oil is then cooled and expansion is allowed to take place. T. A. S.

DISTILLING OIL WITH ALUMINIUM CHLORIDE.—A. M. McAfee, Assr. to Gulf Refining Co. U.S.P. 1,478,444 of Dec. 25, 1923. (Appl. Jan. 13, 1922.)

High boiling oil is distilled with anhydrous aluminium chloride at a pressure greater than atmospheric. Lower boiling oils are produced. T. A. S.

METHOD OF REFINING OILS.—W. J. Reilly. U.S.P. 1,479,833 of Jan. 8, 1924. (Appl. April 6, 1922.)

Heavy oil is cracked by passing it into a distillation chamber, where it is mixed with vapours heated to the temperature required to produce conversion. The oil and vapour are passed through a helical chamber to insure good mixing, and then over a catalyst. After passing through another helical chamber the vapours are expanded and condensed under a desired pressure. T. A. S.

APPARATUS FOR CRACKING AND DISTILLING OILS.—J. G. Davidson, Assr. to C. H. Conner. U.S.P. 1,479,776 of Jan. 1, 1924. (Appl. Jan. 26, 1923.)

One or more massive electrical resistances are suspended in a large body of oil contained in a still. Polyphase alternating current is supplied to the resistances. T. A. S.

PROCESS OF MIXING AND DELIVERING OIL AND ALUMINIUM CHLORIDE.—G. H. King, Assr. to Gulf Refining Co. U.S.P. 1,478,438 of Dec. 25, 1923. (Appl. Nov. 12, 1921.)

Oil and aluminium chloride are mixed in a closed vessel connected with that into which the mixture is to be delivered. By forcing into the mixing chamber oil of the same character as that mixed with the aluminium chloride, the mixture is displaced and delivered at the required point. T. A. S.

METHOD OF CRACKING OILS.—J. G. Davidson, Assr. to C. H. Conner. U.S.P. 1,479,653 of Jan. 1, 1924. (Appl. Oct. 24, 1922.)

Oil is cracked by suspending in it large resistances heated by means of polyphase, alternating current. The carbon deposits on the resistances are periodically removed without taking the resistances from the still. T. A. S.

APPARATUS FOR AND METHOD OF CRACKING HYDROCARBONS. F. E. Wellman, Assr. to The Kansas City Gasoline Co. U.S.P. 1,478,413 of Dec. 25, 1923. (Appl. April 21, 1920.)

Oil is rapidly circulated through a tube system maintained at cracking temperature. It is then passed into a less constricted space, where

carbon is allowed to settle out. After the removal of carbon the oil is again passed through the tube system and the cracked products are removed as vapour. T. A. S.

PROCESS OF TREATING HYDROCARBONS.—G. Egloff. U.S.P. 1,478,559 of Dec. 25, 1923. (Appl. Sept. 17, 1917.)

T. A. S.

PROCESS OF TREATING HYDROCARBONS.—G. Egloff. U.S.P. 1,478,559 of Dec. 25, 1923. (Appl. Sept. 17, 1917.)

Oil contained in a still is heated by external means to distillation temperature. Heating is continued by means of an electrical resistance contained in the body of the oil. A pressure of over 20 lb. per sq. in. is maintained on the oil during treatment. T. A. S.

LUBRICATING OIL AND WAX.

THE EXTRACTION OF MINERAL OILS WITH METHYL ALCOHOL.—H. Stäger. *Helv. Chim. Acta*, 1923, **6**, 893–900.

During investigation of the sludge-formation of transformer oils a number of oils were extracted with methyl alcohol and the extracts and extracted oils were submitted to the usual tests. The alcohol extracts contained unsaturated cyclic bodies and, on oxidation with sodium peroxide products of high acidity were obtained. Considerable sludge formation was observed with the extracted oils when heated at 112° in the presence of copper. T. A. S.

THE SOLVENT-INDEX OF REFRACTION METHOD OF DETERMINING OIL IN WAX. R. E. Wilson and R. E. Wilkin.

The report describes a method developed in the laboratories of the Standard Oil Co. (Indiana) for determining the oil content of paraffin wax. The wax (5 gr.) is dissolved in 75 c.cm. of ethylene dichloride cooled to 0°F., and filtered in Holde's apparatus or any other cooled filtering apparatus. The precipitate is washed with 75 c.cm. of ethylene dichloride, the washings and filtrate are bulked and evaporated. The wax in the residue is determined by mixing with a known volume of mineral seal-ligature oil solvent (index 1·4470), about 0·2 c.cm. being generally required. A determination of the index of refraction of this solution enables the percentage of oil present to be made by means of prepared curves. The method gives satisfactory checks on Mid-Continent waxes, but requires further examination with wax and oil made from other crudes. The press method of determining the oil in wax is adversely criticised. T. A. S.

SOME EXPERIMENTS IN THE LUBRICATION OF COMMERCIAL VEHICLE ENGINES. —H. D. Nickinson. *Automobile Engineer*. XIV. 1924.

The author records at length some observations made on the lubrication of commercial vehicle internal-combustion engines over periods of six months. (Distances run varied from 10,456 to 24,678 miles.) Seven oils differing widely in quality and price were used. One oil contained deflocculated graphite, and another was a compounded oil containing 2 per cent. of fatty oil. The other five were straight mineral oils. New or recently overhauled engines were used for the tests. The oil sumps were filled to the correct level at the start, make-up oil being added as

required. The oil sumps were never drained out during the run. Charts are given showing the variation in specific gravity, flash point, viscosity, and acidity of the oils during the run. Interesting observations are made on crank-case or fuel dilution of lubricating oil. At the end of the test the engines were dismantled and examined for wear and carbon deposits. The weight of the latter is given in certain cases. Numerical ratio between the weights of carbon deposits and the Conradson carbon values for the oils cannot be traced. Cylinder wear, oil and petrol consumptions are tabulated. Cylinder wear and petrol consumption varied but little with the different lubricants. Oil consumption showed considerable variation. The author does not place much reliance on the oil consumption figures, for in one case they do not approximate to those obtained in fleet operation in eighty vehicles. The results of the tests show that the cheapest oil has done the job as satisfactorily as the most expensive oil. R. W. L. C.

Specific Heats of Lubricating Oils.—H. L. Leslie & J. C. Geniesse.

The specific heats of six typical lubricating oils have been measured and found to increase 35–40 per cent. between 100°F. and 290°F. Lack of definite knowledge prevents any conclusions being drawn from the facts with regard to the association or dissociation of oil molecules. It is suggested that an investigation of the relationship between specific heat, viscosity, lubricating value, might yield results of value in the selection of oils. T. A. S.

Emulsions and Method of Preparation.—P. M. Travis and C. A. Glabau. E. P. 195,033 of June 23, 1922. Conv. (U.S.) March 17, 1922.

A mixture of 40 parts mineral oil, 59·5 parts water, and 0·5 part sodium oleate are agitated for 10 minutes and then forced through a homogeniser at a pressure of from 1200–3500 lb. per sq. in. The result is a permanent emulsion suitable for use as a lubricant. T. A. S.

Improvements in the Manufacture of Lubricants.—Plausons, Ltd. E.P. 208,267 of Sept. 29, 1922.

Lubricants containing solid particles—*e.g.*, graphite—are obtained by treating graphite mixed with mineral oil, in the presence of suitable dispersators, in a colloid mill. Suitable dispersators are fatty acids, esters, ketones or ethers of high molecular weight. When graphite (140 parts) is mixed with mineral oil (400 parts) containing arachidic acid (2 parts) for 5–10 minutes in a colloid mill running at 12,000 r.p.m. a stable homogeneous dispersion is obtained which is a good lubricant. T. A. S.

Improved Apparatus for Sweating or Crystallising Paraffin or other Wax.—The Burmah Oil Co., H. L. Allan & J. Moore. E.P. 208,195 of Sept. 15, 1922.

The apparatus consists of a number of superposed and spaced horizontal plate cells through which a heating or cooling medium may be circulated. The spaces between the cells form wax and oil chambers, having gauze floors supported on radial wooden strips. The apparatus is enclosed in a heat-insulated shell. The wax chambers are charged with wax and the cooling water circulating in the cells is reduced in temperature, so that slow crystallisation takes place. When the desired amount of crystallisation has been produced the drain cocks are opened and the temperature of the circulating water raised until the desired

amount of sweating has taken place. The sweated scale is then melted out. The better control of the cooling and heating operations enables a better product in larger yield to be obtained than in any other apparatus. T. A. S.

COMPOSITE LUBRICANTS.—D. K. Dodge. U.S.P. 1,477,635 of Dec. 18, 1923. (Appl. July 11, 1922.)

Castor oil is distilled until about 6·5 per cent., comprising the acids and aldehydes, has been removed. The residue is air blown until a point of rapid increase in gumminess is reached, and light mineral lubricants are then added. T. A. S.

COAL SHALE AND ASPHALT.

THE DESTRUCTIVE DISTILLATION OF OIL SHALE.—R. J. G. Stewart & J. Trenchard. *Quarterly of the Colorado School of Mines*, 1923, **18**, No. 3.

The authors have made a study of retorting problems such as (1) the effect of heat and rate of heating of shales; (2) size of shale; (3) effect of pressure and vacuum; and (4) quality of oil produced from shale. After a general resumé of the history of the oil shale industry and the methods employed therein a description is given of the laboratory retort used by the authors. This consisted of an 8-inch brass cylinder 21 inches long, wound with nichrome wire in such a way as to obtain even heating by electric current throughout its length, and efficiently lagged to prevent loss of heat. The retort is rotated mechanically, and is supplied at either end with pipes through stuffing boxes for removing oil vapours and holding the pyrometer. The condenser consisted of a series of water-cooled U-tubes connected together and furnished with draw-off cocks at the base of each "U." The shale is crushed to three different sizes, and with each the rate of temperature rise; duration of heating and maximum temperature reached were varied in order to study their effects on the total yield of oil produced; the percentage of unsaturated hydrocarbons formed, and the economic value of the result as a whole. The conclusions arrived at are:—(1) That for similar rates of temperature rise there is an earlier and more rapid production with smaller size of shale; (2) rapid heating to a maximum temperature increases the yield and produces more oil on an economic basis; (3) the yield increases with increase in size of shale and with early high temperatures; (4) the greater bulk of the oil is produced below 600°F.; (5) the percentage of unsaturated hydrocarbons increases with rapid heating and with size of shale; and (6) the use of vacuum on the retort causes oil to come over earlier and not so rapidly, but it is longer in reaching the uneconomical rate of production. Vacuum, however, materially increases the percentage of unsaturated compounds and also the total yield. In order to prove that increased yield was due to size of shale particles and not to extra richness, the large lumps were broken down to small mesh and retorted. A decrease of yield was again found with diminution in size of the particles, thus refuting Gavin's contention that the poorer parts of the shale crush easier, and hence account for the smaller yield of oil. F. G. P. R.

ASPHALT SPECIFICATIONS.—U.S. Bureau of Standards—Simplified Practice Recommendation No. 4. *Chem. Met. Eng.*, 1923, **29**, No. 27, 1189.

Owing to the multiplicity and non-uniformity of specification requirements for asphalt for road-making a joint conference of manufacturers and the Bureau of Standards recommended that for construction of sheet asphalt, asphaltic concrete, asphalt macadam pavements and surface treatment, the penetration limits are to be 25 to 30, 30 to 40, 40 to 50, 50 to 60, 60 to 70, 85 to 100, 100 to 120, 120 to 150, and 150 to 200. For joint filler for various types of construction the penetration limits are to be from 30 to 50, 50 to 60, 60 to 70, and 85 to 100.

F. G. P. R.

SOLIDIFIED OIL FUEL.—R. Illeman. E.P. 206,889 of July 12, 1922.

Oils, such as mineral, animal, vegetable or fish oils, waxes or bituminous substances are incorporated with peat. Black peat containing about 75 per cent. of water is ground and about 25 per cent. of oil, calculated on the wet peat, is added. The pasty mass can be briquetted, and on drying yields a tough, solid block which can be handled without disintegrating, and is suitable for use under boilers or domestic stoves.

T. A. S.

IMPROVED PROCESS FOR OBTAINING OIL FROM SHALE AND NON-COKING COALS.—H. Edwards & G. Young. E.P. 207,073 of Jan. 9, 1923.

The process is a modification of E.P. 153,663, and gives increased yields of condensable oils and ammonia. The ground material is passed through a number of superimposed distilling chambers containing rotating platforms across which the material is caused to travel by means of stationary deflectors, whilst similar deflectors attached to the under-side of the platform traverse the material in the opposite direction. Means are provided to enable the products of distillation to be removed from the distillation chamber. The temperature of each distillation chamber is so controlled that complete distillation of the material takes place at the lowest possible temperature. When desired, the operation may be carried out in superheated steam. T. A. S.

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR EXTRACTING OIL FROM SHALE AND THE LIKE.—S.E. Co., Assrs. of G. W. Wallace & D. J. L. Davis. E.P. 204,335 of Sept. 20, 1923.

The invention relates to shale retorts, particularly those of the type in which a downwardly progressing zone of combustion is caused to travel through an upright column of the material under treatment. The bottom closure of the retort consists of an oil receptacle and a superposed grate, the whole making an air-tight fit over the bottom of the retort and capable of being bodily moved when distillation is finished to allow of the discharge of the spent shale from the retort. The bottom closure is mounted on track wheels and the bottom of the retort arranged that all portions of the closure move out of contact with it simultaneously, thereby minimising friction. T. A. S.

APPARATUS FOR DISTILLING HYDROCARBONS.—C. W. Thompson. U.S.P. 1,475,901 of Nov. 27, 1923. (Appl. Jan. 27, 1922.)

The material to be distilled is fed to a conveyor, which passes it through an externally heated, horizontal retort. A number of ports are provided in the upper portion of the distillation chamber for the removal

of volatile matter. The diameter of the conveyor is increased where it passes through the distillation chamber. T. A. S.

SOLE-HEATED COKE OVEN.—T. von Bauer & B. Zwillinge. U.S.P. 1,478,410 of Dec. 25, 1923. (Appl. March 3, 1921.)

The floor of an elongated oven, adapted to receive the charge in a horizontal layer, is formed of a plurality of combustion flues for heating the oven. Cross channels at both ends of the oven communicate with the said flues, and means are provided for supplying both air and gas to the flues and cross channels. T. A. S.

RETORT FURNACE.—C. V. McIntyre. U.S.P.

Destructive distillation is carried out in a stationary retort fitted with means for agitating and breaking up the material to be distilled. Means are also provided for injecting a fluid into the retort at distributed points along a portion of the retort wall normally covered by the material being distilled. T. A. S.

APPARATUS FOR TREATING HYDROCARBON-CONTAINING MATERIALS.—C. P. Bowie & M. J. Gavin. U.S.P. 1,480,045 of Jan. 8, 1924. (Appl. June 1, 1922.)

The retort consists of a circular heating hearth with a conduit for the discharge of spent material at the periphery. The material to be distilled is fed into the centre of the hearth and caused to travel outwards by means of revolving disc-rabbles. The heating is arranged so that the temperature increases in passing from the centre to the circumference of the hearth. T. A. S.

CURRENT BIBLIOGRAPHY.

Compiled by W. J. Wilson, F.I.C., A.C.G.I.

1. Geological.

Oil Finding Up-to-date.—F. R. Rees. Sullivan Machinery Company. *Oil Weekly* **31**, (13), 75.

Salt and Petroleum.—*Rassegna Mineraria. Oil Engineering and Finance* **5**, 90.

Oil Possibilities of the Lower Fraser Valley, British Columbia.—W. A. Johnston. Canad. Dept. Mines, Geol. Surv. Branch. *Petr. Times* **11**, 160.

Geology of the Nivio Valley, Otago.—J. Henderson. *N. Zealand J. Sci. Tech.* **6**, 123. *Chem. Abstr.* **18**, 211.

Geology of the Norman Oil Fields and a Reconnaissance of a Part of Laird River.—G. S. Hume. *Canad. Dept. Mines Summary Rept.* 1923, Part B, 47. *Chem. Abstr.* **18**, 211.

The Possibilities of Oil and Gas in South-west Virginia as inferred from Isocarbs.—J. B. Eby. *Bull. Am. Assoc. Petroleum Geol.* **7**, 421. *Chem. Abstr.* **18**, 212.

Notes on the Stratigraphy of Producing Sands in Northern Louisiana and Southern Arkansas.—J. P. D. Hull. *Bull. Am. Assoc. Petroleum Geol.* **7**, 362. *Chem. Abstr.* **18**, 212.

Results and Prospects of Deeper Drilling in the Rocky Mountain Fields.—C. T. Lupton. *Bull. Am. Assoc. Petroleum Geol.* **7**, 400. *Chem. Abstr.* **18**, 212.

Geology and Structure of Portion of Grand and San Juan Counties, Utah.—H. W. C. Prommel. *Bull. Am. Assoc. Petroleum Geol.* **7**, 384. *Chem. Abstr.* **18**, 212.

The Petroleum Possibilities of Honduras.—A. H. Redfield. *Econ. Geol.* **18**, 474. *Chem. Abstr.* **18**, 212.

On the Relative Value of Species of Smaller Foraminifera for the Recognition of Stratigraphic Zones.—T. W. Vaughan. *Oil Engineering and Finance* **5**, 143.

The Relation of Quality of Oil to Structure at El Dorado, Arkansas.—H. A. Ley. *Bull. Am. Assoc. Petroleum Geol.* **7**, 350. *Oil Engineering and Finance* **4**, 325. *Chem. Abstr.* **18**, 513.

The Oil Fields of Roumania.—S. L. Mason. *Petr. Times* **10**, 693. *Chem. Abstr.* **18**, 514. *Oil Trade J.* **14**, (11), 64.

F*

PETROLEUM PROVINCES IN THE UNITED STATES.—E. R. Lilley.—*Eng. and Min. J.-Press. Petr. Times* **11**, 391.

RESEARCH ON TEXAS ARM OF GULF EMBAYMENT.—F. J. Fohs. *Oil Weekly* **32**, (9), 21.

DEVELOPMENTS—MARICOPA-SUNSET FIELD—CALIFORNIA.—W. A. Clute. *Min. and Oil Bull.* **9**, 1069.

STRUCTURE OF LOS ANGELES BASIN AND ENVIRONS.—J. E. Eaton. *Oil Age* **20**, (6), 8; **21**, (1), 16.

PALÆONTOLOGISTS NOW EMPLOYED TO DELIMIT GULF SALINE DOMES.—P. L. McGreal. *Oil and Gas J.* **23**, (1), 121.

COLORADO OIL SHOWING FROM UNEXPECTED DEPTH.—*Oil Weekly* **31**, (6), 21.

EASTERN ALBERTA WELL'S PERFORMANCE IS BIG ENCOURAGEMENT.—L. E. Smith. *Nat. Petr. News* **15**, (50), 59.

LULING TESTS WEST CENTRAL TEXAS LIME.—G. Triplett. *Oil and Gas J.* **22**, (22), 58.

STRUCTURAL AND STRATIGRAPHIC DATA OF NORTH-EAST TEXAS PETROLEUM AREA.—J. Fohs and H. M. Robinson. *Econ. Geol.* **18**, 709.

ACCUMULATION OF PETROLEUM IN UNDERGROUND RESERVOIRS.—H. L. Garner. *Inland Oil Index* **8**, (Dec. 22), 4.

POSSIBILITY OF FINDING OIL IN DEEP SANDS NEAR UPTON, WYOMING.—*Inland Oil Index* **8**, (Dec. 29), 10.

LEEDY BEND TESTS ATTRACTING ATTENTION IN WESTERN OKLAHOMA.—*Oil and Gas J.* **23**, (5), 126.

WILDCAT DEVELOPMENT WORK IN ARKANSAS.—F. P. Peterson. *Oil and Gas J.* **23**, (4), 70.

OIL AND GAS IN THE TEXAS PANHANDLE.—W. Pratt. *Nat. Petr. News* **15**, (30), 57. *Oil Weekly* **30**, (9), 13.

MIGRATION OF PETROLEUM IN OIL INCRUSTATIONS.—V. Sach. *Petroleum* **19**, 806.

DISCUSSION OF THEORIES OF PETROLEUM MIGRATION.—K. Friedl. *Petroleum* **19**, 849.

WARNER'S FIELD MAPPING FOR THE OIL GEOLOGIST.—C. A. Warner. John Wiley and Son, Inc., New York, London.

PROSPECTING FOR OIL AND GAS.—L. S. Panyity. John Wiley and Son, Inc., New York.

2. GEOGRAPHICAL.

USE MODERN EQUIPMENT IN EGYPTIAN OIL WORK.—K. J. Fanshier. *Oil Weekly* **32**, (1), 11.

THE NEW ROUMANIAN PETROLEUM TRADE REGULATIONS.—*Moniteur du Petrole Roumain. Oil Engineering and Finance* **5**, 82.

American Oil Production, 1923.—Am. Petr. Institute. *Oil Engineering and Finance* **5**, 109.

Venezuela: Development of the Oil Industry.—*Petr. World* **21**, 53.

Baku in Fiscal Year 1922-23.—*Petr. World* **21**, 53.

Financial, Commercial and Economic Conditions in the Argentine Republic.—H. C. Chalkley. Dept. of Overseas Trade. *Petr. World* **21**, 67.

Italian Oil Production and Needs.—L. Dominian. *U.S. Consular Rept. Petr. World* **21**, 73.

A New Petroleum Discovery in Russia. *Min. J. (Russia).* *Petr. Times* **11**, 151.

The Future of the Californian Oilfields.—H. B. Milner. *Petr. Times* **11**, 152.

The Argentine Petroleum Industry.—Commercial Secretary to His Majesty's Legation, Buenos Ayres. *Petr. Times* **11**, 158.

1923: Complete Oil Imports and Exports.—*Petr. World*, **21**, 63.

Oil Resources of the British Empire.—E. H. C. Craig. *United Empire, Canad. Min. J.* (Dec. 14). *Petr. Times* **11**, 209.

The American Petroleum Industry. Official Review for 1923.—*Petr. Times* **11**, 221.

Petroleum Prospects in North Africa.—*Petr. Times* **11**, 226.

The Californian Petroleum Industry. Review for 1923.—Calif. State. Mining Bureau. *Petr. Times* **11**, 241.

Petroleum in North-West India.—*Petr. Times* **11**, 245.

A Petroleum Prospect in Montenegro.—G. Petunnikoff. *Petroleum. Petr. Times* **11**, 246.

Mexico: British Official Report.—N. King. *Oil News* **15**, 120.

Investigation of Petroleum and Natural Gas in Alberta.—D. B. Dowling. *Canad. Dept. Mines Summary Rept.* 1923, Part B, 101. *Chem. Abstr.* **18**, 211.

The Petroleum Possibilities of Venezuela.—J. F. Sheridan. *Petr. Times* **10**, 595, 681. *Chem. Abstr.* **18**, 324.

German Supply of Lubricants, History of its Development and its Future.—A. Franke. *Petroleum* **19**, 875, 912, 942, 963, 995. *Chem. Abstr.* **18**, 325.

Colombia: Openings for British Capital.—*Oil News* **15**, 221.

Report on Mineral Production in California for 1922.—W. W. Bradley. State Mining Bureau.

Belgian Oil Trade in 1923.—*Petr. World* **21**, 104.

Venezuela.—*Petr. World* **21**, 111.

The Long Beach Oilfield.—J. B. Case and R. L. Keyes. *Petr. Times* **21**, 301.

CALIFORNIA FIELDS: THE PETROLEUM SITUATION TO-DAY.—*Oil Engineering and Finance* **5**, 153.

IS THERE OIL IN GREECE?—*Oil Engineering and Finance* **5**, 139.

NEW ZEALAND MINERAL OILS.—T. H. Easterfield and N. McClelland. *Chem. and Ind.* **42**, 936. *Chem. Abstr.* **18**, 462.

KENTUCKY OIL HAS BIG GASOLINE CONTENT.—G. Egloff. *Oil and Gas J.* **22**, (27), 76. *Chem. Abstr.* **18**, 463.

VISCOSITY OF FUEL OIL FROM PANUCO CRUDE.—R. H. Brownlee and W. H. Coburn. *Oil and Gas J.* **22**, (24), 84. *Chem. Abstr.* **18**, 464.

EMPIRE OIL: THE PROGRESS OF SARAWAK.—T. G. Cochrane. *Petr. Times* **11**, 335, 367.

SURVEY OF PACIFIC COAST PETROLEUM PRODUCTS. III. BURNING FUEL AND FUEL OILS.—E. C. Lane and W. F. Le Jeune. *U.S. Bureau Mines Repts. Investigations* 2511. *Chem. Abstr.* **18**, 163.

RECENT EXPLORATION FOR PETROLEUM IN THE UNITED KINGDOM.—E. L. Ickes. *Trans. Am. Inst. Min. Met. Eng.* 1279-P. *Oil Weekly* **32**, (3), 25. *Chem. Abstr.* **18**, 163.

AMERICAN PETROLEUM REFINING INDUSTRY. OFFICIAL STATISTICS FOR 1923.—*Petr. Times* **11**, 365.

FRENCH FIELDS IN LINE FOR BIG DEVELOPMENT.—*Oil Weekly* **32**, (8), 14.

WITH FLUSH GONE OLD FIELDS AGAIN TO FRONT.—K. C. Wallace. *Oil Weekly* **32**, (8), 20.

NEW OKLAHOMA FIELD MIGHT BE A FACTOR.—W. L. Sloan. *Oil Weekly* **32**, (8), 49.

GEOLOGICAL SURVEY OF CANADA REPORT OF THE OIL SITUATION IN CANADIAN FIELDS.—G. S. Hume. *Oil Weekly* **32**, (9), 47. *Petr. Times* **11**, 422.

BURBANK FIELD PRODUCED 32,754,320 BARRELS IN 1923.—W. B. Frothingham. *Oil Trade J.* **15**, 25.

MANY FACTORS IN BIG OUTPUT OF PAST YEAR.—*Oil Weekly* **32**, (7), 15.

THE CHEMICAL PROPERTIES OF CALIFORNIAN PETROLEUMS.—P. W. Prutzman. *Petr. Times* **10**, 733; **11**, 151. *Chem. Abstr.* **18**, 462, 749.

WORLD PRODUCTION OF PETROLEUM IN 1923. *Petr. Times* **11**, 451.

ROUMANIAN PETROLEUM INDUSTRY.—*Moniteur du Petrole Roumain. Petr. Times* **11**, 460.

THE SEARCH FOR OIL IN AUSTRALIA.—*Petr. World* **21**, 133.

GERMAN OIL INDUSTRY AND TRADE.—*U.S. Dept. of Commerce Rept. Petr. World* **21**, 145.

ARGENTINE STATE OIL INDUSTRY.—*U.S. Dept. Commerce Rept. Petr. World* **21**, 146.

OIL REFINERIES IN PERU AND ECUADOR.—*Oil and Gas J. Petr. World* **21**, 146.

PETROLEUM TRADE IN CUBA. *Petr. World* **21**, 147.

U.S. OIL REFINING IN 1923. *Petr. World* **21**, 162.

WORLD PRODUCTION OF PETROLEUM. *Petr. World* **21**, 162.

CALIFORNIA TENDENCY TOWARD BETTER YIELDS.—C. J. von Bibra. *Ref. and Nat. Gas. Mfr.* **3**, (3), 23.

COST OF OIL PRODUCTION IN THE UNITED STATES.—Hoover. Ohio Gas and Oil Men's Convention. *Natural Gas* **4**, (Nov.), 5.

WILL OIL BE FOUND IN NEVADA ?—L. Balliet. *Oil Age* **20**, (6), 32.

WEWOKA FIELD ON EVE OF BIGGER PLAY; PRODUCTION HOLDS UP WELL. —A. F. Hinton. *Nat. Petr. News* **15**, (46), 17.

HYDROCARBON WEALTH OF THE STATE OF UTAH: A COMPREHENSIVE REVIEW OF THE SITUATION.—J. B. Jenson. *Salt Lake Min. Review* **25**, (Nov. 15), 11.

TRYING FOR OIL FIELD NEAR FERNIE, B.C.—*Nat. Petr. News* **15**, (47), 47. *Oil Weekly* **31**, (22), 21.

COMPANIES DRILLING ON ALASKA PENINSULA ARE MAKING SLOW PROGRESS. —*Nat. Petr. News* **15**, (45), 47.

POWELL FIELD, TEXAS: HISTORY AND PRODUCTION.—*Nat. Petr. News* **15**, (44), 26.

WYOMING INVASION OF CALIFORNIA.—*Oil Age* **20**, (6), 39.

HISTORIC WELLS IN THE AMERICAN FIELDS.—*Oil and Gas J.* **22**, (27), 84.

UTAH NOT BEING OVERLOOKED IN PROSPECTING.—*Oil Weekly* **31**, (24), 19.

LOOKING FOR GAS AND FIND OIL IN ALBERTA; CRUDE HAS ASPHALTIC BASE AND LOW GRAVITY.—*Oil Weekly* **31**, (23), 39.

UNION'S BIG GASSER OF GREATEST IMPORTANCE TO COLORADO SINCE GOLD STRIKE AT CRIPPLE CREEK.—*Petroleum World* (Los Angeles) **8**, (Nov.), 19.

OIL STORIES OF INTEREST IN TWO STATES.—*Railroad Red Book* **40**, 999.

SHELL INTERESTS ARE ONLY PRODUCERS IN THE EGYPTIAN FIELDS.—R. O. Rhoades. *Nat. Petr. News* **15**, (45), 61.

BRIEF HISTORY OF THE PETROLEUM INDUSTRY IN MONTANA.—E. G. Robinson. *Midwest Review* **3**, 6.

REVIVAL OF OIL INDUSTRY IN KERN COUNTY.—K. C. Wallace. *Oil Age* **20**, (4), 38.

WELLINGTON.—C. H. Wegemab. *Inland Oil Index* **8**, (Dec. 1), 12.

OIL POSSIBILITIES OF ALASKA.—*Inland Oil Index* **8**, (Nov. 24), 10.

PETROLEUM PRODUCTION OF TRINIDAD FOR 1922.—*U.S. Commerce Repts.* (Nov. 26), 560.

PRODUCTION OF THE BAKU AND GROSNY OIL FIELDS OF RUSSIA. DEVELOPMENT AND PRODUCTION STATISTICS FOR THE FISCAL YEAR, 1922-1923.—*U.S. Commerce Repts.* (Nov. 26), 560.

CANADIAN OIL PRODUCTION FOR 1922.—*U.S. Commerce Repts.* (Nov. 12), 433. *Canad. Chem. and Met.* **7**, 282.

EXPLORATION PLANS FOR THE COMING YEAR.—J. McIntyre. *Oil and Gas J.* **22**, (27), 62.

MAP OF THE MARICOPA DISTRICT SOUTH MIDWAY OIL FIELD, KERN COUNTY, CALIFORNIA.—*Min. and Oil Bull.* **9**, *Supplement.*

WILDCATTING IN SOUTH AMERICA.—N. O. Fanning. *Oil and Gas J.* **23**, (3), R10.

INTERESTING FACTS ON VENEZUELA.—W. M. Dunham. *Oil and Gas J.* **23**, (3), R17.

OIL OPERATIONS IN VENEZUELA SHOW PROMISING INDICATIONS.—N. O. Fanning. *Oil and Gas J.* **23**, (3), 94.

NEW OIL FIELDS IN EGYPT.—K. J. Fanshier. *Oil News* (U.S.A.) **11**, (Dec.), 11.

CANADIAN PIONEER RECALLS EARLY DAYS AROUND OIL SPRINGS.—V. Lauriston. *Oil and Gas J.* **23**, (3), 154.

THE NEW COLORADO "GASSER."—*Min. and Oil Bull.* **9**, 1082.

ENGINEER DESCRIBES OIL POSSIBILITIES OF SAKHALINE ISLAND.—C. W. Purington. *Nat. Petr. News* **15**, (40), 71.

OIL STRIKE REPORTED IN EAST-CENTRAL ALBERTA.—*Oil Weekly* **31**, (9), 38.

EARLY OIL DEVELOPMENT IN CALIFORNIA.—W. W. Orcutt. *Petr. World* (Los Angeles) **8**, (Nov.), 17.

CALIFORNIA'S REMARKABLE OIL PROGRESS TRACED TO EARLY EFFORTS OF STATE'S PIONEERS.—W. W. Orcutt. *Petr. World* (Los Angeles) **8**, (Dec.), 23.

CRUDE PETROLEUM PRODUCTION OF THE ASSAM OIL FIELDS.—*U.S. Commerce Repts.* (28), 109. *Nat. Petr. News* **15**, (29), 91. *Oil and Gas J.* **22**, (19), 214.

WILDCAT DRILLERS TESTING OUT SOUTHERN STATES.—*Oil Trade J.* **15**, (1), 42.

OIL FOUND IN WAINWRIGHT, CANADA, AREA; TERRACE STRUCTURE NOT WELL DEFINED.—*Oil Weekly* **32**, (1), 40.

POWELL TOPS SANTA FE SPRINGS IN FLUSH OUTPOUR OF PRODUCTION.—P. Wagner. *Nat. Petr. News* **15**, (44), 25.

1922 PETROLEUM PRODUCTION IN VENEZUELA.—*Oildom* **14**, (Dec.), 19.

CALIFORNIA MINERAL PRODUCTION FOR 1922. FUELS.—*Calif. State Mining Bureau Bull.* 93 (Sept.), 16.

CALIFORNIA MINERAL PRODUCTION FOR 1922. STRUCTURAL MATERIALS.—*Calif. State Mining Bureau Bull.* 93 (Sept.), 67.

WHEN WILL CALIFORNIA REACH ITS PEAK OF OIL PRODUCTION?—J. Jensen. *Eng. and Min. J.-Press* **116**, 1023.

RECORD OUTPUT OF 757,899,507 BARRELS IS SET FOR U.S. FIELDS DURING 1923. *Oil Weekly* **32**, (2), 11.

SLUMP IN OUTPUT HURTS POLAND'S OIL TRADE.—*Oil Weekly* **32**, (2), 15.

OIL POSSIBILITIES OF MADAGASCAR.—*Petr. Times* **21**, 295.

3. DRILLING AND FIELD OPERATIONS.

MANUAL FOR OIL AND GAS OPERATORS.—T. E. Swigart and C. E. Beecher. *U.S. Bureau Mines Bull.* 232. *Petr. Times* **21**, 313.

DRILLING WELLS WITH A DIAMOND CORE DRILL.—F. R. Rees. *Oil Trade J.* **15**, (1), 46.

GAS CONTENT OF WATER AIDS IN FINDING OIL.—G. W. Jones, W. P. Yant and E. P. Buxton. *U.S. Bureau Mines Repts. Investigations* 2553. *Oil Weekly* **32**, (3), 13. *Petr. Times* **11**, 332.

NEW COMBINATION SET SHOE AND BACK PRESSURE VALVE.—*Oil Weekly* **31**, (10), 67.

STEEL A BIG FACTOR IN FIELD EFFICIENCY.—F. B. Foley. *Oil Weekly* **31**, (12), 11.

ELECTRICAL POWER FOR DRILLING AND PUMPING.—W. G. Taylor. *Oil Weekly* **31**, (12), 19.

DRILLING COSTS CUT BY LIGHTER EQUIPMENT.—G. Triplett. *Oil Weekly* **31**, (12), 25.

BROWN SUCKER ROD SOCKET IS LATEST FISHING TOOL.—*Oil Weekly* **31**, (12), 67.

IDEAL BACK PRESSURE VALVE OFFERED BY UNION TOOL CO.—*Oil Weekly* **31**, (12), 67.

HAZARDS OF FINDING AND PRODUCING OIL.—E. W. Marland. *Oil Weekly* **31**, (13), 19.

OIL COMPANIES SHOULD HAVE BELT ENGINEER.—R. D. Gwynne. *Oil Weekly* **31**, (13), 21.

PROMOTE SAFETY AND REDUCE TIME LOSSES.—*Oil Weekly* **31**, (13), 33; **32**, (2), 21, (3), 17, (8), 41.

RECOMMENDATIONS FOR ROTARY TOOL JOINTS.—S. A. Guiberson. *Oil Weekly* **32**, (1), 12.

WHEN JUNKED FIELD PIPE IS NOT REALLY JUNK.—*Oil Weekly* **32**, (1), 13.

A.P.I. COMMITTEE REPORT ON STANDARDISATION.—*Oil Weekly* **32**, (1), 23.

ELECTRIC HEATING DEVICE MELTS PARAFFIN OR ASPHALT.—*Oil Weekly* **32**, (1), 67.

RECOMMENDATIONS FOR STANDARD CABLE JOINTS.—*Oil Weekly* **32**, (2), 23.

METHOD OF HANDLING PARAFFIN IN WELLS.—R. van A. Mills. *Oil Weekly* **32**, (2), 25.

NEW PUMP GOOD FOR WELLS THAT FLOW SAND AND WATER.—*Oil Weekly* **32**, (2), 75.

COMPACT GENERATOR AIDS IN OIL FIELD LIGHTING.—*Oil Weekly* **32**, (2), 75.

W.-K.-M. COMPANY OFFERS NEW STANDING VALVE.—*Oil Weekly* **32**, (3), 67.

RATIGAN NEW SUCKER ROD HOOK PROMOTES SAFETY.—*Oil Weekly* **32**, (3), 67.

GUIBERSON COMPANY HAS NEW UNDERREAMER OUT.—*Oil Weekly* **32**, (3), 67.

CASING DEPTHS FOR OIL WELLS.—*Z. Internat. Vereines der Bohringenieure u. Bohrtechniker* **30**, (Dec. 15), 211. *Oil Engineering and Finance* **5**, 81.

TECHNIQUE OF CORE DRILLING.—J. E. Elliott. *Oil Engineering and Finance* **5**, 83.

REVOLUTION IN DEEP DRILLING PRACTICE.—A. P. Serebrovsky. Petroleum. Manage. (Baku). *Petr. World* **21**, 68.

THE MINING METHOD OF WINNING PETROLEUM.—*Petr. Times* **11**, 244.

THE NATIONAL PORTABLE DRILLING RIG.—*Petr. Times* **11**, 266.

MIGRATION OF WATER IN OIL SANDS.—*U.S. Bureau of Mines Bull.* 232. *Petr. World* **21**, 104. *Oil Weekly* **32**, (8), 72.

FISHING EXPERIENCES IN AUSTRALIAN WELLS.—*Oil News* **15**, 290. *Petr. World* **21**, 162.

INDUSTRIAL ACCIDENTS IN THE CALIFORNIA OIL FIELDS.—H. C. Miller. *U.S. Bureau Mines Repts. Investigations* 2557. *Oil News* **15**, 121.

CORRECTIVE WORK FOR AIDING PRODUCTION.—G. O. Suman. *Oil Weekly* **32**, (8), 21.

USING SHOTS FOR REMOVAL OF PARAFFIN IN OIL WELLS.—*Oil Weekly* **32**, (8), 41.

WELL RECORDS PROVE VALUE IN OPERATION.—*U.S. Bureau Mines Bull.* 232. *Oil Weekly* **32**, (8), 41.

RAISING TUBING PREVENTED BY NEW ELEVATOR SUPPORT.—*Oil Weekly* **32**, (8), 83.

NEW STEEL DERRICK ADAPTED TO SERVICE ON DEEP WELLS.—*Oil Weekly* **32**, (8), 83.

OPERATING RULES REVISED IN LOUISIANA.—*Oil Weekly* **32**, (9), 14.

SIMPLICITY MAIN FEATURE OF NEW WORKING BARREL.—*Oil Weekly* **32**, (9), 75.

FOOL-PROOF SWAB EFFECTIVE IN WORK WITH HEAVY OIL.—*Oil Weekly* **32**, (9), 75.

NEW CASINGHEAD AND BLOWOUT PREVENTER SUCCESSFULLY USED.—*Oil Trade J.* **15**, (2), 98.

PLACE GUY WIRES TO HOLD DERRICK.—H. Pennington. *Oil Weekly* **32**, (7), 21.

BUREAU OF MINES BULLETIN GIVE STATISTICS ON ACCIDENTS TO CALIFORNIA FIELD WORKERS.—*Oil Weekly* **32**, (7), 46.

GASOLINE OUTFIT EMBODIES GOOD DRILLING FEATURES.—*Oil Weekly* **32**, (7), 67.

SOME METHODS OF DEALING WITH PARAFFIN PROBLEMS IN OIL WELLS.—R. Van A. Mills. *U.S. Bureau Mines Repts. Investigations* 2550. *Nat. Petr. News* **15**, (52), 58; **16**, (1), 67. *Oil and Gas J.* **23**, (5), 28. *Chem. Abstr.* **18**, 750. *Petr. World* **21**, 45. *Petr. Times* **11**, 171, 207.

NOVEL EXTINCTION OF BURNING GASSER.—*Rig and Reel* (March). *Oil News* **15**, 352.

EFFECT OF IMPROVED TECHNIQUE ON INDUSTRY.—J. E. Pogue. *Oil Weekly* **32**, (5), 19.

INFLUENCES RELATED TO USE OF CEMENT IN WELLS.—L. T. Bachman. *Oil Weekly* **32**, (5), 25.

MINING OIL IN PECHELBRONN.—*The Lamp* **6**, 11.

WHEN THE OPERATOR AGAIN HEARS THE CALL.—L. G. E. Bignell. *Oil and Gas J.* **23**, (1), 34.

STEEL GAINING HEADWAY IN OIL FIELDS.—L. G. E. Bignell.—*Oil and Gas J.* **22**, (27), 72.

USE OF ACID ENDS 15 MOS. FISHING JOB.—*Calif. Oil World* **16**, (Nov. 22), 2.

CORE DRILLING WITH ROTARY IN CALIFORNIA.—J. E. Elliott. *Oil Weekly* **31**, (9), 23. *Oil and Gas J.* **22**, (27), 36.

LIFTING COST DATA OFFERS COMPARISON ON PRODUCING FIGURE.—H. C. George. *Oil and Gas J.* **22**, (26), 116.

OPERATORS IN CHANUTO FIELD CO-OPERATE IN BETTERING METHODS.—A. F. Hinton. *Nat. Petr. News* **15**, (45), 51.

NOTES ON THE EFFECT OF BACK PRESSURE ON WELLS IN THE BROCK FIELD.—J. M. Lovejoy. Amer. Institute of Petr. Technologists. *Nat. Petr. News* **15**, (44), 51.

IMPROVED ROTARY DEVELOPS WIDER USE.—P. L. McGreal. *Oil and Gas J.* **22**, (27), 60.

COMBINATION ROTARY DIAMOND DRILL.—*Min. and Oil Bull.* **9**, 1123.

OIL-FIELD LIGHTING.—*Min. and Oil Bull.* **9**, 1115.

COMMITTEE REPORTS ON STANDARDISED PIPE.—*Oil Weekly* **31**, (8), 17.

DIGGING REGULAR MINE SHAFTS TO SHALLOW SANDS IN GERMANY HELPS RESTORE OUTPUT.—*Oil Weekly* **31**, (8), 9.

UNIQUE DEVICE SUPPLEMENTS PRESENT DRILLING EQUIPMENT.—*Petr. World* (Los Angeles) **8**, (Nov.), 52.

How the Diamond Drill Proved Useful on one Oil Lease.—J. Purser. *Eng. and Min. J.-Press* **116**, 947.

Influence of Heat upon the Recovery Oil by Water Displacement. —A. Schaller and C. A. Bjornsson. *Nat. Petr. News* **15**, (45), 53.

Examination of Water for Petroleum Industry.—E. O. Slater. *Min. and Oil Bull.* **9**, 1097.

Cementing off Caves Saves Expense and Trouble.—L. E. Smith. *Nat. Petr. News* **15**, (49), 25.

Steam Effective when Properly Applied.—G. Triplett. *Oil Weekly* **31**, (21), 25.

Flooding Aids Recovery of Crude Oil.—W. L. Russell. New York State Oil Producers' Assoc. *Oil and Gas J.* **22**, (22), 100.

Bringing in a 10,000 Barrel Well.—R. E. Vivian. *The Record, Assoc. Pacific and Amalgamated Oil Companies* **4**, (Nov.), 9.

California Field Practice is Growing Toward Interchangeable Units.—P. Wagner. *Nat. Petr. News* **15**, (43), 35.

Drilling Hazards Shown by Actual Results Obtained.—*Oil and Gas J.* **22**, (27), 82.

Scientific Oil Finding Instrument.—*Oil Age* **20**, (5), 554.

Committee's Report on Standardisation.—R. T. Baker. *Oil and Gas J.* **23**, (3), 21.

How Big Colorado Gas Producer was Capped.—R. Burnham. *Oil Weekly* **32**, (1), 32.

Notes on California Recovery of Oil by Perforating the Water String.—H. A. Godde. *Nat. Petr. News* **15**, (47), 86. *Oil and Gas J.* **22**, (27), 66.

One Method of Completing a Junked Hole with the Diamond Bit.—*Oil Age* **21**, (1), 45.

Bottom Water More Easily Plugged than that in an Oil Sand.—*Oil and Gas J.* **23**, (5), 96.

Output of Gas per Barrel of Oil is one True Measure of Efficiency. —*Oil and Gas J.* **23**, (4), 58.

The Panorama of Petroleum.—*Oil News* (U.S.A.) **11**, (Dec.), 28.

How Science is Reducing the Oil Man's Fire Bill.—*Petr. World* (Los Angeles) **8**, (Dec.) 76.

Petroleum Engineering in Skull Creek, Okla.—T. E. Swigart. *Oildom* **14**, (Sept.), 42.

Use of Electricity in the Oil Fields.—W. G. Taylor. *Nat. Petr. News* **15**, (52), 67.

Gratifying Progress made by Committees on Equipment and Standardisation.—P. Wagner. *Nat. Petr. News* **15**, (51), 33K.

Measuring Depth Accurately in Rotary Well Drilling.—A. G. Wolf. *Eng. and Min J.-Press* **116**, 1122.

Patents.

Fishing Tool.—T. B. Couch. U.S. Pat. 1,483,079. *Petr. Age* **13**, (5), 52.

Oil Well Pump Piston.—B. D. Thompson. U.S. Pat. 1,480,127. *Petr. Age* **13**, (5), 52.

Apparatus for Melting Paraffin and Base Sediment in Oil Wells.—H. S. Rankin. U.S. Pat. 1,481,624. *Petr. Age* **13**, (4), 62.

Slip.—G. F. Le Bus. U.S. Pat. 1,481,378. *Petr. Age* **13**, (4), 62.

Device for Raising Petroleum and the Like.—J. Streda. U.S. Pat. 1,482,161. *Petr. Age* **13**, (41), 62.

Apparatus for Conserving Gas, Oil and other Fluids.—J. B. Knight. U.S. Pat. 1,472,009. *Petr. Age* **13**, (2), 70.

Well Capping Device.—F. Sievern. U.S. Pat. 1,476,110. *Petr. Age* **13**, (2), 70.

Method of Operating Oil Wells.—C. A. Howard, Assgr. to Standard Development Co. U.S. Pat. 1,473,348. *Petr. Age* **13**, (3), 78.

Fishing Tool for Junk in Wells.—D. L. Gilstrap. U.S. Pat. 1,472,213. *Petr. Age* **13**, (3), 78.

Method of and Apparatus for Renewing Oil Wells.—F. H. Wolever. U.S. Pat. 1,476,747. *Petr. Age* **13**, (3), 78.

Oil Well Tool.—W. P. Stampfli. U.S. Pat. 1,475,456. *Petr. Age* **13**, (2), 70.

Well.—J. N. Swanson. U.S. Pat. 1,476,554. *Petr. Age* **13**, (2), 70.

Oil Well Swab.—E. T. Murray. U.S. Pat. 1,472,487. *Petr. Age* **13**, (2), 70.

Fishing Apparatus for Wells.—A. H. Brandony, Assgn. to Deep Well Engin. Co. U.S. Pat. 1,473,606. *Petr. Age* **12**, (12), 72.

Expansive Underreamer.—L. H. Baldwin. U.S. Pat. 1,470,316.

Drill Bit.—S. F. Bashara and J. F. Bashara. U.S. Pat. 1,476,481.

Flowing Device for Oil Wells.—A. Boynton. U.S. Pat. 1,470,053.

Well Fishing Tool.—C. A. Brust. U.S. Pat. 1,474,232.

Oil Pump.—E. Buckingham. U.S. Pat. 1,470,804.

Reaming Device.—T. P. Carroll and E. Graff. U.S. Pat. 1,470,144.

Sucker-rod Coupling.—R. E. Cox. U.S. Pat. 1,471,106.

Deep-well Pump.—W. E. Ellis. U.S. Pat. 1,476,444.

Derrick Hook.—J. L. Foss. U.S. Pat. 1,471,117.

Rope Socket and Jar.—M. C. Hazard. U.S. Pat. 1,470,445.

Swivel Rope Rocket for Oil-well-Drilling Tools.—G. Jacques. U.S. Pat. 1,467,273.

Oil-well Slush Pump Piston and Pump-piston Packing-adjusting Mechanism.—W. F. McMahon. U.S. Pat. 1,474,201.

ADJUSTER FOR WELL PUMPING APPARATUS.—F. I. Nevill. U.S. Pat. 1,473,968.

SUCKER-ROD REMOVER.—E. Pace. U.S. Pat. 1,475,861.

ROPE GRIP FOR WELL-DRILLING APPARATUS.—A. Premro. U.S. Pat. 1,476,218.

WELL-DRILLING RIG.—R. H. Ramsey. U.S. Pat. 1,470,329.

WELL SCREEN.—H. Rodrigo. U.S. Pat. 1,473,644.

SUCKER-ROD ELEVATOR AND WRENCH.—B. Rose. U.S. Pat. 1,473,684.

DEVICE FOR FORCING FLUID FROM WELLS.—A. L. Smith. U.S. Pat. 1,466,199.

SAND WHEEL FOR OIL WELLS.—E. M. Smith. U.S. Pat. 1,469,828.

BUSHING RETAINER FOR ROTARY DRILL TABLES.—I. E. Zerbe. U.S. Pat. 1,475,360.

CABLE CLAMP FOR WELL-DRILLING RIGS.—O. C. Zuck. U.S. Pat. 1,467,066.

DRILL BIT.—S. F. Bashara and C. Paggi. U.S. Pat. 1,477,931.

DRILL BIT.—S. F. Bashara and J. F. Bashara. U.S. Pat. 1,477,932.

COMBINATION DRILL BIT AND CORE TAKING DEVICE.—S. F. Bashara. U.S. Pat. 1,477,933.

OIL-WELL HEATER.—R. C. Beck. U.S. Pat. 1,477,802.

REAMER.—S. M. Bellringer.—U.S. Pat. 1,470,679.

BULL-WHEEL STRUCTURE FOR DRILLING RIGS.—R. R. Bloss. U.S. Pat. 1,477,237.

AUTOMATIC FISHING TOOL.—A. E. Brady. U.S. Pat. 1,477,535.

FISHING TOOL.—C. H. Brown. U.S. Pat. 1,472,713.

WRENCH FOR OIL-WELL CASINGS.—C. A. Butler. U.S. Pat. 1,478,020.

BAND WHEEL FOR OIL-WELL-DRILLING APPARATUS.—J. E. Campsey. U.S. Pat. 1,478,548.

OIL-WELL UNDERREAMER.—V. L. Conaghan. U.S. Pat. 1,471,102.

OIL OR GAS WELL.—E. V. Crowell. U.S. Pat. 1,472,555.

FISHING TOOL.—C. F. Armond. U.S. Pat. 1,480,378.

OIL-WELL PUMP.—J. S. Feliz. U.S. Pat. 1,477,217.

WELL DRILL.—J. B. Fender. U.S. Pat. 1,475,060.

APPARATUS FOR SHARPENING REAMERS.—B. J. Grundlach. U.S. Pat. 1,478,563.

PERFORATION CLEANER FOR OIL-WELL CASINGS.—A. L. Halliday. U.S. Pat. 1,474,630.

WELL-DRILLING APPARATUS.—H. C. Hirschfold and R. S. Mayer. U.S. Pat. 1,477,563.

ROTARY EARTH-BORING DRILL.—H. R. Hughes. U.S. Pat. 1,474,633.

DRILLING RIG.—W. J. Jeffers. U.S. Pat. 1,476,402.

EXPANSIBLE REAMER.—A. Kutchera. U.S. Pat. 1,479,079.

ATTACHMENT FOR WELL-RIGGING MACHINES.—H. J. Lockhart. U.S. Pat. 1,476,899.

WELL DRILL BIT.—W. R. Lyle. U.S. Pat. 1,479,668.

UNDERREAMER.—T. J. McCormick. U.S. Pat. 1,474,274.

REAMER.—A. McCracken. U.S. Pat. 1,472,182.

SUCTION-ROD GUIDE-CLAMP FOR OIL PUMPS.—T. R. McSpaddon. U.S. Pat. 1,479,193.

TUBE SUPPORT FOR DEEP-WELL PUMPS.—J. Penrod and R. D. Thompson. U.S. Pat. 1,477,714.

ROTARY DRILL BIT.—R. O. Pickin. U.S. Pat. 1,471,526.

JAR HOLDER.—W. H. Platt. U.S. Pat. 1,471,415.

OIL-WELL PACKER.—J. S. Quigg. U.S. Pat. 1,476,727.

FISHING TOOL FOR OIL WELLS.—T. Ratcliffe. U.S. Pat. 1,470,482.

OVERSHOT FISHING TOOL.—J. B. Reilly and C. H. Stone. U.S. Pat. 1,477,593.

SAND-REEL-OPERATING MECHANISM.—R. W. Sage and H. R. Boughner. U.S. Pat. 1,476,935.

OIL-WELL APPARATUS.—H. T. Smith. U.S. Pat. 1,472,283.

UNDERREAMER.—M. M. Smith. U.S. Pat. 1,478,306.

OIL-WELL EQUIPMENT.—R. D. Thompson and J. Penrod. U.S. Pat. 1,479,208.

CHECK UNDERREAMER BLADE.—R. A. Wilson. U.S. Pat. 1,480,357.

CRANE ATTACHMENT FOR HANDLING WELL DRILLING BITS AND THE LIKE.—B. F. Zeigler. U.S. Pat. 1,477,095.

DUPLEX-TABLE ROTARY DRILLING MACHINE.—V. W. Zilon. U.S. Pat. 1,479,165.

4. Pipe-lines, Transport and Storage.

CENTRIFUGAL PUMPS ADAPTED TO PIPE-LINE USE.—W. N. Beadle. *Oil Weekly* **31**, (10), 21.

OVERCOME MANY PROBLEMS IN PIPE-LINE WORK.—D. S. Bushnell. *Oil Weekly* **31**, (12), 29.

A.P.I. Discusses Tank Fire Prevention.—*Oil Weekly* **31**, (13), 29.

Evaporating Loss on Producing Properties can be Effectively Curtailed, Bureau Finds.—J. H. Wiggins. *U.S. Bureau Mines Tech. Paper* 319. *Oil Weekly* **32**, (1), 39. *Chem. Abstr.* **18**, 582. *Petr. Age* **13**, (1), 70. *Chem. and Met. Eng.* **30**, 55.

Concrete Tank Construction and its Use for the Storage of Petroleum.—L. Waterhouse. *Oil Engineering and Finance* **5**, 15, 75.

Flexible Hoses for Benzole and Oil.—*Oil Engineering and Finance* **5**, 93.

Bulk Storage of Petrol for Private Users.—A. Hayes. *Oil Engineering and Finance* **4**, 531; **5**, 48, 115.

Tanker Chartering Review.—J. I. Jacobs and Co. *Oil Engineering and Finance* **5**, 117.

Floating Roofs for Oil Tanks.—L. Schmidt. *Petr. World* **21**, 74.

Marine Oil Transportation.—J. C. Rohlfs. Amer. Petr. Inst. *Petr. Times* **11**, 149.

Tankers and Motor Ships in 1923.—*Petr. World* **21**, 117.

Motor-Centrifugal Pumps for Pipe Lines.—*Petr. World* **21**, 118.

Pipe-line Jointing Materials.—*Oil Engineering and Finance* **5**, 170.

A Floating Roof for Oil Tanks.—L. Schmidt. *U.S. Bureau Mines Repts. Investigations* 2547. *Chem. Abstr.* **18**, 463.

Effect of Cooling Systems on Evaporation Losses of Gasoline.—L. Schmidt. *U.S. Bureau Mines Repts. Investigations* 2531. *Oil and Gas J.* **22**, (21), 96. *Petr. World* **20**, 445. *Chem. Abstr.* **18**, 165.

Further Discussion of Line Pump Efficiency.—E. S. Jenison. *Oil Weekly* **32**, (9), 25.

Making Evaporation an Ally.—C. P. Buck. *Petr. Age* **13**, (1), 18; (2), 23.

Standard Works Out Efficient Method of Closing Pipe Ends by Using Torch.—*Nat. Gas Bull.* (Jan.). *Oil Weekly* **32**, (7), 14.

Novel Marine Loading Station for Argentine Oil.—H. F. Hanssen. *Oil News* **15**, 343.

Stresses in a few Welded and Riveted Tanks tested under Hydrostatic Pressure.—A. H. Stang and T. W. Greene. *U.S. Bureau Standard Tech. Paper* 243.

Vapour Valve Meets Test.—*Petr. Age* **13**, (5), 63.

The Bulk Transportation of Petroleum.—*Petr. Times* **11**, 459.

Jobbers Develop Special Equipment for Distillate Delivery.—J. C. Chatfield. *Nat. Petr. News* **15**, (47), 35.

Concrete Tunnel Conveying Oil Pipe-line.—E. A. Clark. *Eng. World* **23**, 273.

Domestic Vacuum Cleaner Chief Part of Barrel Cleaning Process.—W. K. Halbort. *Nat. Petr. News* **15**, (46), 22.

How Oil Companies Guard against Fires.—*Min. and Oil. Bull.* **9**, 1075.

Converts Freight Costs per Cwt. into Barrels and Gallons.—*Nat. Petr. News* **15**, (45), 91.

Corrections of Gauged Volume of Oil to 60° F.—*Oil and Gas News* **13**, (Dec. 3), 16.

A New For of Evaporation.—*Petr. Age* **12**, (10), 68. *Oil Weekly* **21**, (7), 65.

Cooling Devices and Evaporation Losses.—L. Schmidt. *Oil and Gas J.* **22**, (21), 96.

Government Tests with Floating Roof.—L. Schmidt. *Oil and Gas J.* **23**, (1), 84. *Petr. World* (Los Angeles) **8**, (Dec.), 60.

The Care of Fire-prevention Apparatus.—R. J. Scott. *Min. and Oil Bull.* **9**, 1061.

Tapping Large Gas Mains under Heavy Pressure.—M. R. Thompson. *Nat. Gas.* **4**, (Nov.), 30.

Development of Pipe-line Welding.—N. E. Wagner. *Oil and Gas. J.* **22**, (26), 28.

Problems of Pipe-line Transportation.—D. S. Bushnell. Amer. Petr. Inst. *Petr. World* (Los Angeles) **8**, (Dec.), 66.

Annual Fire Bill of Petroleum Producers.—*Inland Oil Index* **8**, (Nov. 17), 11.

Observing These Precautions will Remove Trouble met in Unloading Tank Cars.—J. W. Lewis. *Petr. World* (Los Angeles) **8**, (Dec.), 70.

A Good Investment—the 3,000,000 Barrel Oil Reservoir.—*Petr. World* (Los Angeles) **8**, (Dec.), 52.

United States has One-half of Tanker Tonnage of World.—J. C. Rohlfs. *Oil and Gas. J.* **23**, (3), 23.

Pipe-line used to Transport Raw Natural Gasoline.—P. Wagner. *Nat. Petr. News* **15**, (51), 58.

Patents.

Automatic Water Drain for Oil Tanks.—J. A. Jolly. U.S. Pat. 1,471,737. *Petr. Age* **13**, (4), 62.

Evaporation Prevention Mantle.—A. B. Davis. U.S. Pat. 1,479,790. *J. Soc. Chem. Ind.* **43**, n210.

Loading and Discharge Pipe-line System for Oil Tankers.—O. H. G. Steed. U.S. Pat. 1,478,925. *Petr. Age* **13**, (3), 78.

Preservation and Preparation for Transportation of Oil Bearing Raw Material.—A. W. MacIlwaine. U.S. Pat. 1,476,531.

Loading Apparatus for Gasoline Tank Cars.—W. T. Simpson. U.S. Pat. 1,474,297.

Liquid-sealed Tank Dock.—C. R. Gallagher. U.S. Pat. 1,478,359.

FLUID METER.—A. J. Granberg. U.S. Pat. 1,479,961.

FLOW METER.—R. W. Schroeder. U.S. Pat. 1,479,873.

GAUGE AND FILLER SPOUT FOR GASOLINE TANKS.—W. H. Stephenson. U.S. Pat. 1,477,728.

5. REFINERY TECHNIQUE.

GETTING THE MOST OUT OF MEXICAN CRUDE.—F. N. Williams. *Ref. and Nat. Gas Mfr.* **3**, (1), 7; (2), 15.

CRUDE OIL AND ITS YIELD AT THE REFINERY.—F. B. Koontz. *Oil Trade J.* **15**, (1), 35.

USE OF OLD FIRE BRICK IN REFINERY FURNACE CONSTRUCTION.—J. A. Faulkner. *Oil Trade J.* **15**, (1), 82.

DESULPHURATION OF MEXICAN PETROLEUM.—*Matières Grasses* **16**, (Nov. 15). *Oil Engineering and Finance* **5**, 106.

REFINING OF PETROLEUM WITH LIQUID SULPHUR DIOXIDE.—L. Edeleanu. *Z. angew. Chem.* **36**, 576. *Oil Engineering and Finance* **5**, 108. *Petroleum* **19**, 1195. *Petr. Times* **10**, 916. *J. Soc. Chem. Ind.* **43**, b44. *Oesterr. Chem.-Zeit.* **26**, 164. *Chem. Abstr.* **18**, 750.

THE USE OF SOLID AGENTS IN REFINING MINERAL OILS.—*Petr. Times* **11**, 168.

DEMULSIFYING CALIFORNIA OIL BY CHEMICAL TREATMENT.—V. W. Killick. *Petr. World* (Los Angeles). *Petr. Times* **11**, 247.

RECOVERY OF GASOLINE FROM UNCONDENSED STILL VAPOURS.—D. B. Dow. *U.S. Bureau Mines Tech. Paper* 310. *Petr. World* **21**, 89, 136. *Oil Trade J.* **15**, (2), 90. *Ref. and Nat. Gas. Mfr.* **3**, (2), 40. *Oil Engineering and Finance* **5**, 172. *Petr. Age* **13**, (2), 16.

THE RÔLE OF ADSORPTION IN PETROLEUM REFINING.—H. L. Kauffman. *Chem. and Met. Eng.* **30**, 153.

THE ACID AND FULLER'S EARTH TREATMENT OF CALIFORNIA CRACKED DISTILLATES.—G. Egloff and J. C. Morrell. *Oil Age* **20**, (10), 20. *Chem. Abstr.* **18**, 324.

THE MORE ADVANCED METHODS IN THE TREATMENT OF CRUDE OILS.—Cull and Co.'s *Financial Review. Oil Engineering and Finance* **5**, 163.

SIMPLIFYING THE SOLUTION OF PROBLEMS OF FLUID FLOW.—B. F. Dodge. *Chem. and Met. Eng.* **29**, 844. *Chem. Abstr.* **18**, 430.

FRACTIONATING PETROLEUM.—E. H. Leslie. *Oil News* (U.S.A.) **11**, (18), 11. *Chem. Abstr.* **18**, 462.

PETROLEUM RESINS AND THEIR UTILISATION.—H. Siebeneck. *Petroleum* **19**, 939. *Chem. Abstr.* **18**, 462.

MAKING THE REFINERY SHOW A PROFIT BY REDUCING OPERATING COSTS.—P. Truesdell. *Nat. Petr. News* **15**, (48), 23; (49), 35; (50), 35; (52), 23. *Chem. Abstr.* **18**, 463, 750.

Pipe Stills Aid Output of Skimming Plants.—F. N. Williams. *Ref. and Nat. Gas. Mfr.* **2**, (11), 11. *Chem. Abstr.* **18**, 463.

Mixing and Treating Oil Sands.—G. Schneiders. *Petroleum* **19**, 1059. *Chem. Abstr.* **18**, 464.

Centrifugal Separation: Wax from Lubricating Oils.—L. D. Jones. *Chem. and Met. Eng.* **29**, 883. *Chem. Abstr.* **18**, 465.

Absorption in Petroleum Refining.—*Petr. Times* **11**, 354.

The Laws of Heat Transfer.—G. C. Webster. *Engineering* **116**, 1, 69, 131, 228. *Chem. Abstr.* **18**, 136.

How do You Operate a Column Still?—F. H. Rhodes. *Chem. and Met. Eng.* **28**, 590. *Chem. Abstr.* **18**, 137.

Refinery Operation Problems.—R. L. Walde. *Oil and Gas J.* **22**, (23), 66. *Chem. Abstr.* **18**, 163.

Problems met in Refinery Construction.—R. L. Walde. *Oil and Gas J.* **22**, (22), 84. *Chem. Abstr.* **18**, 163.

Recovery of Alkaline Waste Liquors from Petroleum Refining.—A. O. Yourkfe. *Azerbaidj. Neft. Choz.* **3**, (2). *Chim. et Ind.* **10**, 478. *Chem. Abstr.* **18**, 163.

Some Refining Processes and Yields of Various Methods.—F. B. Koontz. *Nat. Petr. News* **15**, (41), 28. *Chem. Abstr.* **18**, 164.

Purification of Oils by Centrifugation.—A. F. Meston. *Oil and Gas J.* **22**, (20), 56. *Chem. Abstr.* **18**, 164.

Distilling Column Design and Performance. IV.—E. H. Leslie. *Oil News* (U.S.A.) **12**, (1), 16. *Chem. Abstr.* **18**, 721.

Modern Heat Exchange Equipment.—G. A. Burrell. *Chem. and Met. Eng.* **30**, 436.

Use of Silica Gel in Petroleum Refining.—E. B. Miller. *Oil and Gas J.* **23**, (3), 104. *Chem. Abstr.* **18**, 749.

Methods of Blending Natural Gasoline.—H. R. Noble. Assoc. of Natural Gasoline Mfrs. *Ref. and Nat. Gas. Mfr.* **3**, (3), 31.

Electrical Dehydration of Cut Oil Efficient and Inexpensive.—F. D. Mahone. Amer. Inst. of Petr. Tech. *Nat. Petr. News* **15**, (44), 83.

Methods of Blending Naphtha into Commercial Gasoline.—H. R. Noble. *Oil and Gas J.* **22**, (26), 90.

Patents.

Process for Purifying Liquids (Mineral Oils).—S. D. Hall, Assr. to De Laval Separator Co. U.S. Pat. 1,474,629. *Chem. Abstr.* **18**, 583.

Method of Revivifying finely divided Fuller's Earth, Bone Char and the Like.—F. W. Manning, Assr. to Manning Refining Equipment Corp. U.S. Pat. 1,475,502. *J. Soc. Chem. Ind.* **43**, B118. *Chem. Abstr.* **18**, 574.

DISTILLING MATERIALS (EMULSIFIED OILS) IN CONTACT WITH POROUS MATERIALS.—B. Gallsworthy, Assr. to The Texas Co. U.S. Pat. 1,477,642. *J. Soc. Chem. Ind.* **43**, B124. *Chem. Abstr.* **18**, 751.

PURIFYING MINERAL OIL.—A. E. Dunstan. Brit. Pat. 201,223. *Chem. Abstr.* **18**, 325.

REFINING MINERAL OIL.—P. T. Sharples. Brit. Pat. 201,986. *Chem. Abstr.* **18**, 325.

CONCENTRATING ACIDS.—I. Hechenbleikner and T. C. Oliver. Brit. Pat. 198,545. *Chem. Abstr.* **18**, 326.

COOLING (OIL) STILLS.—T. L. Watkeys, Assr. to Gulf Refining Co. U.S. Pat. 1,476,744. *J. Soc. Chem. Ind.* **43**, B164.

REVIVIFYING FULLER'S EARTH, DECOLORISING CARBON AND SIMILAR MATERIALS.—F. W. Manning. U.S. Pat. 1,473,491. *Chem. Abstr.* **18**, 450.

REFINING PETROLEUM OILS.—C. B. Forward. U.S. Pat. 1,473,402. *Chem. Abstr.* **18**, 465.

REFINING HYDROCARBONS.—Plauson's (Parent Co.) and H. Plauson. Brit. Pat. 202,422. *Chem. Abstr.* **18**, 465.

SEPARATING HYDROCARBONS FROM WATER.—W. A. Brown. U.S. Pats. 1,472,384-5. *Chem. Abstr.* **18**, 466. *J. Soc. Chem. Ind.* **42**, 1214A.

DECOLORISING AND PURIFYING OILS.—P. W. Prutzmann and C. J. von Bibra, Assrs. to General Petroleum Corp. U.S. Pat. 1,471,201. *J. Soc. Chem. Ind.* **43**, B9. *Chem. Abstr.* **18**, 166.

FILTERING MATERIAL.—H. S. Thatcher. U.S. Pat. 1,477,394. *Chem. Abstr.* **18**, 559.

SEPARATING OIL FROM EMULSIONS.—C. H. Hapgood. U.S. Pat. 1,474,670. *Chem. Abstr.* **18**, 559.

SULPHONIC ACIDS FROM PETROLEUM ACID SLUDGE.—R. E. Humphreys, F. M. Rogers and O. E. Bransky. U.S. Pat. 1,474,933. *Chem. Abstr.* **18**, 584.

EXTRACTING PARAFFIN, ETC., WAX.—Whitehall Petroleum Corp., Ltd. Brit. Pat. 203,098. *Chem. Abstr.* **18**, 584.

PROCESS FOR PURIFYING MINERAL OILS.—A. Rialland. Brit. Pat. 193,029. *J. Soc. Chem. Ind.* **43**, B209.

PROCESS OF MIXING AND DELIVERING OIL AND ALUMINIUM CHLORIDE.—G. H. King, Assgnr. to Gulf Refining Co. U.S. Pat. 1,478,438. *Petr. Age* **13**, (3), 78.

TREATMENT OF MINERAL OILS.—V.L. Oil Processes, Ltd., and O. D. Lucas. Brit. Pat. 211,664. *Chem. Age* **10**, 333.

METHOD AND APPARATUS FOR TREATING FILTERING MATERIALS.—J. R. McConnell. U.S. Pat. 1,479,998.

6. NATURAL GAS.

NATURAL GASOLINE INDUSTRY ON WEST COAST.—R. E. Becker. *Ref. and Nat. Gas. Mfr.* **3**, (1), 15.

Flow from Burma Gas Wells being Utilised.—*Oil Weekly* **32**, (1), 46.

The Monroe Gasfield, Louisiana.—H. A. Wheeler. *Min. and Eng. J.-Press. Petr. Times* **11**, 190.

Production of Petrol from Casinghead Gas. Tide Water Topics.—L. F. Bayer. *Oil News* **14**, 288; **15**, 142.

Carbon Black Making Capacity Doubled in Past Two Years.—*Oil and Gas J.* **23**, (1), 60. *Chem. Abstr.* **18**, 307.

Roumania's Natural Gas Fields.—*Petr. World* **21**, 114.

Conversion of Natural Gasoline Plants.—L. F. Bayer. *Ref. and Nat. Gas. Mfr.* **3**, (2), 12.

Contents of Helium and other Constituents in Japanese Natural Gas.—N. Yamada. *Rept. Aeronautical Res. Inst. Tokyo Imp. Univ.* **1**, (6), 171.

Short Cuts in Testing Natural Gas by the Charcoal Method.—R. C. Alden. *Nat. Petr. News* **15**, (48), 89. *Chem. Abstr.* **18**, 459.

Uses and Limits of Charcoal Plants.—G. G. Oberfell and R. C. Alden. Assoc. Nat. Gas Mfrs. *Oil and Gas J.* **22**, (26), 72. *Chem. Abstr.* **18**, 465. *Nat. Gas.* **4**, (Dec.), 14.

A Natural Gasoline Era.—G. A. Burrell. *Petr. Age* **12**, (7), 48. *Chem. Abstr.* **18**, 165.

Carbon Monoxide Hazards from House Heaters Burning Natural Gas.—G. W. Jones, L. B. Berger and W. F. Holbrook. *U.S. Bureau Mines Tech. Paper* 337.

Report on Monroe, La., Gas Field.—H. W. Bell. *Dept. of Conservation, State of Louisiana Rept. Oil Trade J.* **15**, (2), 78.

Compression and Absorption Plants.—D. E. Foster. *Oil and Gas J.* **23**, (4), 76. *Chem. Abstr.* **18**, 750.

Wilshie Casinghead Gasoline Plant.—M. S. Brandt. *Oil Age* **20**, (6), 41. *Chem. Abstr.* **18**, 750.

Modern Natural Gas Engineering.—E. J. Stephany. *Proc. Eng. Soc. Western Pennsylvania* **39**, 267.

Estimating the Yearly and Total Production of Gas Wells.—T. H. Kerr and C. C. Phillips. *Nat. Gas.* **4**, (Nov.), 8. *Oil and Gas J.* **22**, (27), 68.

Present Conditions in Southern California Fields with Suggestions for Improvement of Plant Recovery.—E. R. Cox. *Oil Age* **20**, (6), 48.

Application of Natural Gas and Waste Gas from Petroleum Stills.—Y. Tanaka. *J. Chem. Ind.* (Japan) **24**, 789.

Natural Gas as Fuel.—W. B. Tourtellotte. *Min. and Oil Bull.* **9**, 1901.

The Petrolia, Texas, Helium Supply.—G. A. Burrell. *Nat. Gas.* **4**, (Nov.), 19.

Rate of Gas Decline in Burbank Studied by Gasoline Plants.—J. C. Chatfield. *Nat. Petr. News* **15**, (46), 41.

CARBON BLACK MANUFACTURE.—*Inland Oil Index* **8**, (Nov. 17), 9.

HISTORY OF NATURAL GASOLINE RECOVERY.—G. A. Burrell. *Nat. Gas.* **4**, (Dec.), 6.

NATURAL GAS IN TRANSYLVANIA.—E. G. Sievers. *Nat. Gas.* **4**, (Dec.), 26.

MINE BUREAU EXPERTS FIND NEW GAS ZONE IN EAST SMACKOVER.—*Oil and Gas J.* **23**, (3), 68.

MEASUREMENT, COMPRESSION AND TRANSMISSION OF NATURAL GAS.—L. C. Lichty. John Wiley and Sons, Inc., New York.

CARBON BLACK, INDUSTRIAL HYDROGEN AND MOTOR FUELS DISCUSSED.—*Canad. Chem. and Met.* **7**, 314.

RESIDUE FROM CASINGHEAD GAS ONCE WASTED NOW REVENUE SOURCE.—H. M. Houston and J. B. O'Connor. *Oil and Gas J.* **23**, (5), 36.

OKLAHOMA'S PLACE IN NATURAL GASOLINE INDUSTRY.—*Nat. Gas.* **4**, (Dec.), 51.

GROWTH AND PRESENT STATUS OF THE NATURAL GASOLINE INDUSTRY.—H. J. Struth. *Nat. Gas.* **4**, (Dec.), 17.

CARBON PLANT DEMONSTRATES.—*Inland Oil Index* **8**, (Dec. 15), 12.

CARBON MONOXIDE FATALITIES FROM NATURAL GAS HEATERS INVESTIGATED BY THE BUREAU OF MINES IN THE PITTSBURGH DISTRICT DURING THE PAST YEAR.—G. W. Jones and W. P. Yant. *U.S. Bureau Mines Repts. Investigations* 2572.

PATENTS.

PROCESS OF MAKING CARBON BLACK.—J. W. Martin, Assr. to Carbide and Carbon Chemicals Corp. U.S. Pat. 1,477,511. *J. Soc. Chem. Ind.* **43**, B102. *Chem. Abstr.* **18**, 573.

SEPARATION OF BLACK (CARBON) COLOURS (PAINTS).—F. Uhde and T. W. Pittmann. Ger. Pat. 382,506. *J. Soc. Chem. Ind.* **43**, B103.

REMOVAL OF HYDROGEN SULPHIDE FROM GASES.—W. J. Mollerah-Jackson. From Koppers Co. Brit. Pat. 209,169. *Chem. Age* **10**, 145. *J. Soc. Chem. Ind.* **43**, B164.

EXTRACTING OILS FROM GASES.—K. Ikeda and T. Okazawa. Brit. Pat. 202,795. *Chem. Abstr.* **18**, 301.

PROCESS OF SEPARATING CONSTITUENTS OF MIXTURES OF GASES AND VAPOURS.—Farbw. vorm. Meister, Lucius, u. Brüning. Brit. Pat. 195,098, 195,400. *J. Soc. Chem. Ind.* **43**, B157.

PROCESS FOR REMOVING HYDROGEN SULPHIDE AND OTHER IMPURITIES FROM GASES AND CERTAIN LIQUIDS.—The Koppers Co., Assees. of F. W. Sperr, and R. E. Hall. Brit. Pat. 190,115. *J. Soc. Chem. Ind.* **43**, B164.

PROCESS FOR REMOVING HYDROGEN SULPHIDE AND OTHER IMPURITIES FROM GASES.—The Koppers Co., Assees. of F. W. Sperr. Brit. Pat. 190,116. *J. Soc. Chem. Ind.* **43**, B164.

PROCESS AND APPARATUS FOR PURIFYING GASES.—The Koppers Co. Brit. Pat. 209,378. *J. Soc. Chem. Ind.* **43**, B165.

Process and Apparatus for Purifying Gases (from Hydrogen Sulphide, etc.).—The Koppers Co., Assees. of J. A. Shaw. Brit. Pat. 190,119. *J. Soc. Chem. Ind.* **43**, B166.

Gasoline Recovery.—W. Brink. U.S. Pat. 1,477,103. *Chem. Abstr.* **18**, 583.

Gas Purifying Apparatus.—E. H. Bird, Assr. to The Koppers Co. U.S. Pat. 1,478,543. *J. Soc. Chem. Ind.* **43**, B209.

Apparatus for Purifying Gases.—The Koppers Co., Assees. of E. H. Bird. Brit. Pat. 190,117.

Special Carbon Black.—R. H. Brownlee and R. H. Uhlinger. U.S. Pat. 1,478,730. *J. Soc. Chem. Ind.* **43**, B224. *Chem. Abstr.* **18**, 735.

Solid Adsorbents for Gases.—B. Lambert. Brit. Pat. 188,786. *Chem. Abstr.* **18**, 735.

Method of Recovering Gasoline.—L. V. Warren. U.S. Pat. 1,484,922. *Ref. and Nat. Gas Mfr.* **3**, (3), 35.

7. Petrol and other Motor Fuels.

Detonation in Motor Fuels.—H. Moore. *Oil Engineering and Finance* **5**, 114.

Industrial Alcohol, the Production and Use of Alcohol for Industrial Purposes, for Use as an Illuminant and as a Source of Motive Power. J. G. M'Intosh. Scott, Greenwood and Son, London.

Producer Gas versus Petrol.—*Petr. Times* **11**, 278.

Exhaust Gas Composition of Internal Combustion Engines.—*Oil Engineering and Finance* **5**, 166.

Motor Fuels and Engines of the Future.—H. Carey. *Oil and Gas J.* **22**, (36), 94. *Chem. Abstr.* **18**, 455.

The Marketing of Tetraethyl Lead as an Anti-knock Compound in Gasoline.—R. E. Wilson. *Chem. Bull* (Chicago) **10**, 283.

Manufacture of Pynol.—*Oil News* **15**, 254.

Study of the Possible Composition of the (French) National Liquid Fuel.—C. Legrand. *Chim. et Ind.* **10**, 411. *Chem. Abstr.* **18**, 159.

Fuels for Internal-combustion Engines, with Special Reference to Alcohol Production.—F. Nathan. *Fuel* **2**, 249. *Chem. Abstr.* **18**, 159.

The Development of "Anti-knock" Substances.—*Petr. Times* **11**, 388.

Natural Gas Gasoline in 1922.—*Petr. Age* **12**, (12), 61.

Gasoline Blamed Too Often.—A. P. Bjerregaard.—*Petr. Age* **12**, (11), 67.

Comparative Tests with Motor Benzol, Tetralithenuel Reichskraftstoff and Benzol Spirit.—F. Hausser, R. Bestehorn and H. Ellerbusch. *Ber. Ges. Kohlentechn.* **4**. *Chem.-Zentr.* **94**, IV, 220.

USE OF BENZINE FROM GAS PRODUCED BY LOW-TEMPERATURE CARBONISATION AS MOTOR FUEL.—F. Hausser, R. Bestehorn and H. Ellerbusch. *Ber. Ges. Kohlentechn.* **4**, 205. *Chem.-Zentr.* **94**, IV, 220.

BENZOL AS ENGINE FUEL.—A. C. Fieldner and G. W. Jones. *U.S. Bureau Mines Rept. Investigation. J. Soc. Auto. Engineers* **13**, 379.

GERMAN MOTOR FUEL IN ENGLAND.—*U.S. Commerce Repts.* (Nov. 12). *Oil Paint and Drug Reptr.* **104**, (Nov. 12), 44D.

DISCUSSES POSSIBILITIES OF ETHYL GAS.—*Oildom* **14**, (12), 30.

MANY ILLS OF INTERNAL COMBUSTION ENGINES TRACED TO CRANK CASE-OIL DILUTION.—W. F. Parish. *Petr. World* (Los Angeles) **8**, (Nov.), 56.

SPECIAL REPORT ON GASOLINE; SUPPLY, STORAGE AND CONSUMPTION.—*Min. and Met. Soc. of Amer. Bull.* 163.

ETHYL GAS.—G. A. Burrell. *Nat. Gas* **4**, (Dec.), 9.

"KNOCK" IN MOTOR, HOW IT IS CAUSED AND ITS PREVENTION.—T. Midgley. Amer. Petr. Inst. *Oil and Gas J.* **23**, (3), 23.

SHOE NOW ON OTHER FOOT ON INITIAL BOILING POINT.—P. Truesdell. *Nat. Petr. News* **14**, (51), 33 I.

UTILISATION OF AN ALCOHOL-GASOLINE MIXTURE OF HIGH ALCOHOL CONTENT.—Dumanois. *Compt. rend.* **176**, 1449.

WEIGHTED INDEX NUMBER FOR MOTOR FUELS.—W. A. Gruse. *Chem. and Met. Eng.* **30**, 364.

PATENTS.

PRODUCTION OF LIQUID FUEL MIXTURES CONTAINING ALCOHOL.—P. Loriette. Brit. Pat. 188,336. *J. Soc. Chem. Ind.* **43**, B85. *Chem. Abstr.* **18**, 582.

COMPOUND LIQUID FUEL AND METHOD OF PRODUCING THE SAME.—L. du P. Clements, Assr. to Kent County Oil Corp. U.S. Pat. 1,475,259. *J. Soc. Chem. Ind.* **43**, 85. *Chem. Abstr.* **18**, 582.

MOTOR SPIRIT.—J. Diamond. Brit. Pat. 207,883. *J. Soc. Chem. Ind.* **43**, B124.

MOTOR SPIRIT.—H. Terrisse. Brit. Pat. 202,264. *Chem. Abstr.* **18**, 323.

MOTOR SPIRIT.—T. Aspden and W. J. Tolley. Brit. Pat. 202,830. *Chem. Abstr.* **18**, 323.

MOTOR SPIRIT.—J. D. Riedel Akt.-Ges. Brit. Pat. 202,805. *Chem. Abstr.* **18**, 323.

PROCESS FOR MAKING HOMOGENEOUS MIXTURES (MOTOR SPIRITS, ETC.).—J. E. Pollak. From J. D. Riedel A.-G. Ger. Pat. 208,904. *J. Soc. Chem. Ind.* **43**, B159.

FUELS FOR INTERNAL COMBUSTION ENGINES.—General Motors Research Corp., Assees. of T. Midgley. Brit. Pat. 196,237. *J. Soc. Chem. Ind.* **43**, B164.

PRODUCTION OF LIQUID MOTOR FUELS.—K. Kelley, Assgnr. to T. L. Kerr. U.S. Pat. 1,480,808. *Ref. and Nat. Gas. Mfr.* **3**, (2), 34. *J. Soc. Chem. Ind.* **43**, B210.

MOTOR SPIRIT.—K. Hino. Jap. Pat. 41,888. *Chem. Abstr.* **18**, 460.

MOTOR SPIRIT.—K. Hino. Jap. Pat. 41,887. *Chem. Abstr.* **18**, 461.

FUEL FOR INTERNAL COMBUSTION ENGINES.—J. J. Murphy. U.S. Pat. 1,471,566. *J. Soc. Chem. Ind.* **42**, 1213A. *Chem. Abstr.* **18**, 163.

FUEL FOR INTERNAL COMBUSTION ENGINES.—W. C. Perry. U.S. Pat. 1,471,916. *J. Soc. Chem. Ind.* **42**, 1312A. *Chem. Abstr.* **18**, 163.

"NON-FREEZING" LIQUID FUEL.—W. T. Schreiber. U.S. Pat. 1,474,982. *Chem. Abstr.* **18**, 582.

MOTOR SPIRIT FOR USE IN INTERNAL COMBUSTION ENGINES.—J. W. Alexander. Brit. Pat. 209,453. *J. Soc. Chem. Ind.* **43**, B210.

PROCESS OF MANUFACTURING LIQUID FUEL.—J. Black. U.S. Pat. 1,480,368. *J. Soc. Chem. Ind.* **43**, B210.

(LIQUID) FUEL AND PROCESS OF PRODUCTION.—E. A. Charbonneaux. U.S. Pat. 1,480,372. *J. Soc. Chem. Ind.* **43**, B210.

8. KEROSENE.

"SANGAIOL."—R. Junckunz. *Chem. Tech. Fabrik* **19**, 790, 803. *Chim. et Ind.* **10**, 477. *Chem. Abstr.* **18**, 174.

10. LUBRICANTS AND LUBRICATION.

LUBRICATION TESTS REPORTED.—H. D. Nickinson. Inst. of Auto. Engineers. *Oil Paint and Drug Reptr.* **105**, (3), 44A.

WHY AUTOMOBILE OILS MUST BE PERIODICALLY RENEWED.—*Lubrication* **9**, 97.

LUBRICATION OF RAILWAY MOTOR CARS.—*Lubrication* **9**, 104.

LUBRICATION OF REFRIGERATION MACHINERY.—*Lubrication* **9**, 109.

PHYSICAL AND CHEMICAL CHARACTERISTICS OF LUBRICATING OILS.—J. Lévy. *Tech. moderne* **15**, 695.

LUBRICANTS FROM VEGETABLE AND MINERAL OILS.—G. Triplett. *Ref. and Nat. Gas Mfr.* **3**, (2), 23.

DANGERS OF DILUTION OF CRANK CASE OIL.—W. F. Parish. *Oil and Gas J.* **22**, (20), 60. *Chem. Abstr.* **18**, 165.

AIR COMPRESSORS AND THEIR LUBRICATION.—A. L. Nugey. *Oil Trade J.* **15**, (2), 82.

THE PROPERTIES OF A GOOD LUBRICANT.—W. Lee. *Chem. Age* **9**, 513. *Chem. Abstr.* **18**, 750.

COMMERCIAL LUBRICATING OILS.—J. Lévy. *Tech. moderne* **15**, 522.

MAKING OF CUP AND TRANSMISSION GREASE.—F. A. Hoff. *Oil News* (U.S.A.) **11**, (Dec.), 17.

MANUFACTURE OF CUP AND TRANSMISSION GREASES.—H. L. Kauffman. *Oil and Gas News* **13**, (Dec. 17), 12.

THE USE OF LIME IN GREASE MAKING.—H. L. Kauffman. *Oil and Gas News* **13**, (Nov. 19), 18.

EVILS OF CRANKCASE OIL DILUTION IN INTERNAL COMBUSTION ENGINES.—W. F. Parish. *Nat. Petr. News* **15**, (42), 45.

PATENTS.

MANUFACTURE OF LUBRICANTS.—Plauson's (Parent Co.), Ltd. From H. Plauson. Brit. Pat. 208,267. *Chem. Age* **10**, 99. *J. Soc. Chem. Ind.* **43**, B124.

EMULSIONS AND METHOD OF PREPARING THE SAME.—P. M. Travis and C. A. Glabau. Brit. Pat. 195,033. *J. Soc. Chem. Ind.* **43**, B124.

PROCESS OF FORMING COMPOSITE LUBRICANTS (FROM CASTOR OIL).—D. K. Dodge. U.S. Pat. 1,477,635. *J. Soc. Chem. Ind.* **43**, B124. *Chem. Abstr.* **18**, 751.

LUBRICANT CONTAINING SOAP.—M. C. Van Gundy. U.S. Pat. 1,477,611. *Chem. Abstr.* **18**, 751.

LUBRICATING OIL.—G. Shimazu. Jap. Pat. 42,671. *Chem. Abstr.* **18**, 751.

LUBRICATING OIL AND THE MANUFACTURE THEREOF.—J. E. Southcombe and H. M. Wells. U.S. Pat. 1,467,695.

11. FUEL OIL.

COEN SYSTEM OF LOW-PRESSURE MECHANICAL OIL BURNING.—M. Coen Co., Inc., San Francisco.

REFINERY OIL BURNER.—*Chem. and Met. Eng.* **30**, 280.

OIL FUEL BURNING IN MARINE PRACTICE.—J. W. M. Sothern. James Munro and Co., Ltd., Glasgow.

BURNING OIL IN THE AIR FURNACE.—A. V. Landschoot. *Foundry* **51**, 862, *Chem. Abstr.* **18**, 371.

BETTER HOUSE HEATERS CREATE OIL MARKET.—R. T. Baker. *Oil and Gas J.* **23**, (1), 28. *Chem. Abstr.* **18**, 456.

CHEMISTRY OF COMBUSTION OIL AND GAS.—L. Balliet. *Oil and Gas J.* **22**, (25), 23. *Chem. Abstr.* **18**, 456.

DOMESTIC HEATING WITH OIL FUEL STILL IN DEVELOPMENT STAGE.—H. S. Bell. *Nat. Petr. News* **15**, (45), 35. *Chem. Abstr.* **18**, 464.

WE BURN GAS OIL IN WINTER.—S. O. Andros. *Fuels and Furnaces* **1**, 521 *Chem. Abstr.* **18**, 464.

FUEL OIL AND VISCOSITY.—M. G. Langham. *Power* **58**, 423. *Chem. Abstr.* **18**, 159.

FUEL OILS AND THEIR APPLICATION.—H. V. Mitchell. Sir Isaac Pitman and Sons, London.

FUEL OIL FOR POWER PLANTS OF OVER 100 H.P.—G. E. Lawrence. *Oil Trade J.* **15**, (2), 48.

Properties of the Products of Combustion.—R. Brown. *Combustion* **9**, 451.

Purchasing Suitable Fuel Oils.—A. F. Brewer. *Combustion* **9**, 464.

The Simplicity of Oil Burning.—W. R. Quinn. *Combustion* **9**, 449.

Safeguarding the Domestic Oil Burners.—C. R. Wolborn. *Oil and Gas J.* **23**, (4), 34.

Patents.

Oil Burner.—L. E. Herod. U.S. Pat. 1,479,538. *Petr. Age* **13**, (5), 52.

Oil Burning Apparatus.—J. E. Pfeffer. U.S. Pat. 1,481,879. *Petr. Age* **13**, (4), 62.

Motor Fuel.—A. A. Backhaus. U.S. Pat. 1,474,135. *Chem. Abstr.* **18**, 461.

Furnace for Burning Bagasse and Liquid Fuels.—R. Almagro. U.S. Pat. 1,478,418.

12. Diesel Oil and Engines.

Recent Developments of the Heavy Oil Engine.—W. P. Sillence. *Oil Engineering and Finance* **5**, 27, 91.

Internal-combustion Engines.—Inst. of Marine Engineers. *Petr. World* **21**, 68.

Heavy-oil Engine Working Costs.—Diesel Engine Users Assoc. *Petr. World* **21**, 118.

Diesel Engines.—L. H. Morrison. McGraw-Hill Publishing Co., New York and London.

Oil Engines.—A. L. Bird. Methuen and Co.

Qualities and Properties required of Diesel Engine Fuels.—V. Guittis. *Azerbaidj. Neft. Choz.* **3**, 83. *Chim. et Ind.* **10**, 881. *Chem. Abstr.* **18**, 455.

Types of Oil Engines and Advantages of the Various Designs.—F. M. Towl. Ohio Oil and Gas Men's Convention. *Nat. Petr. News* **15**, (44), 45.

Economy of Heavy-oil Engines.—C. Day. *Petr. World* **21**, 154.

The Application of the Diesel Engine to the Yachting Field.—G. A. Colloy. *J. Soc. Auto. Eng.* **13**, 450.

13. Plant and Machinery.

The "Alfa" Oil Cleaning Process.—A. Fischer. *Wärme und Kälte Tech.* **25**, 69. *Chem. Abstr.* **18**, 164.

New Valve Seat and Liner Aid to Removing Pump Parts.—*Oil Weekly* **32**, (7), 67.

MODERN PARAFFIN FACTORY EQUIPMENT.—*Petr. World* **21**, 149.

PIPE TURNING IRON AND TRENCH HORSE.—O. J. Osborn. *Nat. Gas* **4**, (Nov.), 30.

REFINERY FINISHES GASOLINE DISTILLATE WITHOUT RERUNNING.—*Calif. Oil World* **16**, (Dec. 6), 8.

REMARKABLE CLAIMS FOR NEW LOS ANGELES DISTILLING PROCESS.—*Oil and Gas J.* **23**, (1), 82.

RECENT TYPES OF CONSTRUCTION OF RETURN-COOLING SYSTEMS.—F. Seufert. *Z. Ver. deut. Ing.* **65**, 1307.

SAFEGUARDING DOMESTIC OIL BURNER.—C. R. Wellborn. *Laboratories Data (Underwriters' Laboratories)* **4**, 226.

A NEW CENTRIFUGAL FOR SEPARATING SOLIDS FROM LIQUIDS.—C. R. Platzmann. *Chem. Zeit.* **47**, 167.

PATENTS.

SUCTION ROD GUIDE CLAMP FOR OIL PUMPS.—T. R. McSpaddan. U.S. Pat. 1,479,193. *Petr. Age* **13**, (5), 52.

OIL PURIFYING MECHANISM.—W. W. Nugent. U.S. Pat. 1,481,525. *Petr. Age* **13**, (4), 62. *Ref. & Nat. Gas Mfr.* **3**, (2), 34.

OIL BURNER.—L. M. Goldsmith. U.S. Pat. 1,474,900. *Petr. Age* **13**, (2), 70.

PROCESS AND APPARATUS FOR BURNING HEAVY HYDROCARBONS.—P. L. G. Kreutzberger and P. Germain. U.S. Pat. 1,473,566. *Petr. Age* **13**, (3), 78.

OIL BURNER.—J. E. Pearson. U.S. Pat. 1,473,511. *Petr. Age* **13**, (3), 78.

OIL INJECTOR.—H. A. Eklund. U.S. Pat. 1,473,475. *Petr. Age* **13**, (3), 78.

CENTRIFUGAL SEPARATORS.—Aktiebolaget Separator. Brit. Pat. 202,962. *J. Soc. Chem. Ind.* **43**, B81.

APPARATUS FOR DISTILLING HYDROCARBONS.—C. W. Thompson. U.S. Pat. 1,475,901. *J. Soc. Chem. Ind.* **43**, B84.

APPARATUS FOR DISTILLING OIL.—T. E. Robertson. From Power Specialty Co. Brit. Pat. 207,041. *J. Soc. Chem. Ind.* **43**, B84.

ELECTRO-CENTRIFUGAL SEPARATOR.—A. Marx. Brit. Pat. 201,907. *J. Soc. Chem. Ind.* **43**, B117.

METHOD OF SEPARATING ONE OR MORE SUBSTANCES FROM OTHER SUBSTANCES.—Aktiebolaget Separator. Brit. Pat. 203,324. *J. Soc. Chem. Ind.* **43**, B117.

APPARATUS FOR CONDENSING DISTILLED VAPOURS.—D. de Bethune. U.S. Pat. 1,478,206. *J. Soc. Chem. Ind.* **43**, B119. *Chem. Abstr.* **18**, 602.

DISTILLING HYDROCARBONS.—M. Simonoff, M. Beninson and F. Gros. Brit. Pat. 200,118. *Chem. Abstr.* **18**, 326.

HEAT EXCHANGING DEVICES.—A. Dargatz. Brit. Pat. 196,256. *J. Soc. Chem. Ind.* **43**, B157.

HEAT EXCHANGER.—J. Schneible. U.S. Pat. 1,479,088. *J. Soc. Chem. Ind.* **43**, B157.

BODY FOR FILLING COLUMNS, TOWERS, ETC.—G. Petzel, Assr. to G. Weinmann. U.S. Pat. 1,480,463.

HEAT EXCHANGING APPARATUS.—M. L. Pourcel. Brit. Pat. 194,712.

APPARATUS FOR SWEATING OR CRYSTALLISING PARAFFIN OR OTHER WAX.—The Burmah Oil Co., H. L. Allan, and J. Moore. Brit. Pat. 208,195. *J. Soc. Chem. Ind.* **43**, B165.

ELECTRIC DEHYDRATOR.—F. W. Harris. U.S. Pat. 1,480,064. *Ref. and Nat. Gas. Mfr.* **3**, (2), 33. *J. Soc. Chem. Ind.* **43**, B210.

DEHYDRATOR.—W. Meredith. U.S. Pat. 1,480,091. *Ref. and Nat. Gas. Mfr.* **3**, (2), 34. *J. Soc. Chem. Ind.* **43**, B210.

HEATING COLUMN STILLS FOR PETROLEUM DISTILLATION.—H. L. Doherty. U.S. Pat. 1,472,116. *Chem. Abstr.* **18**, 465. *Petr. Age* **13**, (2), 70.

CONDENSING APPARATUS FOR TREATING PETROLEUM VAPOURS.—J. W. Lewis. U.S. Pat. 1,472,075.

APPARATUS FOR RECOVERING GAS AND VAPOURS FROM FRESH PETROLEUM FROM WELLS.—H. P. Porter. U.S. Pat. 1,471,705.

APPARATUS FOR SEPARATING OIL AND GAS FROM WELLS.—A. M. Ballard. U.S. Pat. 1,471,088.

APPARATUS FOR REFINING CRANK CASE OIL IN INTERNAL COMBUSTION ENGINES.—R. C. Aland. U.S. Pat. 1,471,374.

FULLER'S EARTH REVIVIFYING FURNACE.—J. R. McConnell. U.S. Pat. 1,479,998. *Chem. and Met. Eng.* **30**, 322.

DISTILLING COLUMN.—E. Piron. U.S. Pat. 1,475,243. *Chem. Abstr.* **18**, 487. *J. Soc. Chem. Ind.* **43**, B41.

APPARATUS FOR EXTRACTING OIL FROM OIL-BEARING SANDS AND ROCKS.—W. J. Reilly. U.S. Pat. 1,475,028. *Chem. Abstr.* **18**, 584. *J. Soc. Chem. Ind.* **43**, B47.

RETORTS OR STILLS.—F. Lamplough and N. C. T. Harper. Brit. Pat. 211,219. *Chem. Age* **10**, 299.

DISTILLING MINERAL OILS.—K. Fuchs. Brit. Pat. 209,771. *Chem. Age* **10**, 300.

SEPARATING OIL FROM WATER.—Vickers, Ltd., and Sir James McKechnie. Brit. Pat. 211,352. *Petr. Times* **11**, 462.

FRACTIONATING, DISTILLING AND SCRUBBING COLUMN.—M. Mackenzie. Brit. Pat. 211,542. *Chem. Abstr.* **10**, 332.

OIL GAUGE.—A. A. Ashworth and R. V. Quick. U.S. Pat. 1,476,321.

SEPARATING HYDROCARBONS FROM WATER.—W. A. Brown. U.S. Pat. 1,472,384–5.

DEHYDRATING OIL CONTAINER.—E. J. Hunt. U.S. Pat. 1,475,548.

APPARATUS FOR TREATMENT OF ASPHALT.—H. R. Wardell. U.S. Pat. 1,448,370.

FUEL VAPORISER FOR EXPLOSIVE ENGINES.—M. Beck. U.S. Pat. 1,472,284.

CARBURETTOR-LOCKING DEVICE.—C. R. Bowman and C. E. Yates. U.S. Pat. 1,475,275.

ATOMISER.—W. E. Brown and C. T. Brown. U.S. Pat. 1,476,589.

CARBURETTOR.—D. Cole. U.S. Pat. 1,470,616.

CARBURETTOR.—E. P. du Pont. U.S. Pat. 1,466,704.

AUTOMATIC CARBURETTOR CONTROL AND INDICATOR.—S. E. Foreman. U.S. Pat. 1,475,380.

FUEL-MIXTURE HEATING AND VAPORISING DEVICE.—W. W. Grant. U.S. Pat. 1,474,359.

CARBURETTER.—R. O. Henszey. U.S. Pat. 1,474,968.

LIQUID-FUEL VAPORISER.—G. Keith and W. A. Whatmough. U.S. Pat. 1,471,470.

AUXILIARY AIR-INLET VALVE FOR CARBURETTORS.—W. E. Kent. U.S. Pat. 1,475,837.

THERMOSTATIC CONTROL MECHANISM FOR CARBURETTORS.—F. S. Lack. U.S. Pat. 1,474,532.

VAPORISER FOR LIQUID FUEL.—J. A. La Rue. U.S. Pat. 1,467,800.

DEVICE FOR FEEDING MOIST AIR AND STEAM TO CARBURETTORS.—C. V. McCarley. U.S. Pat. 1,470,692.

VAPORISING ATTACHMENT FOR INTERNAL COMBUSTION ENGINES.—J. Medvecky. U.S. Pat. 1,474,909.

VACUUM CARBURETTOR.—E. L. Meisinger. U.S. Pat. 1,472,660.

FUEL VAPORISING AND MIXING MECHANISM.—F. D. Mowen. U.S. Pat. 1,472,665.

CARBURETTOR.—A. T. Newman. U.S. Pat. 1,475,404.

CARBURETTOR.—J. W. Parkin. U.S. Pat. 1,475,719.

INTERNAL-COMBUSTION ENGINE VAPORISING ATTACHMENT.—L. L. Patterson. U.S. Pat. 1,474,605.

CARBURETTOR.—R. M. Tangye. U.S. Pat. 1,471,220.

VAPORISER FOR INTERNAL-COMBUSTION ENGINES.—A. J. Taylor. U.S. Pat. 1,472,233.

VAPORISING DEVICE FOR GASOLINE ENGINES.—C. D. Turner. U.S. Pat. 1,467,126.

VAPORISER AND PRIMER.—E. O. Wolff. U.S. Pat. 1,467,259.

Process and Apparatus for Condensation.—K. P. McElroy. U.S. Pat. 1,478,750.

Carburettor.—J. B. Dutour. U.S. Pat. 1,473,720.

Vortex-type Updraft Carburettor.—R. F. and O. H. Ensign. U.S. Pat. 1,477,946.

Carburettor.—G. C. Farris. U.S. Pat. 1,478,895.

Carburettor.—C. E. Fleming. U.S. Pat. 1,476,701.

Liquid Fuel Strainer.—H. V. Compf. U.S. Pat. 1,478,785.

Liquid-fuel Vaporiser.—J. Good. U.S. Pat. 1,479,381.

Carburettor.—R. W. Kambak. U.S. Pat. 1,479,547.

Carburettor for Internal-combustion Engines.—D. Pordes. U.S. Pat. 1,477,280.

Method of and Apparatus for Atomising and Burning Fuel Oil.—E. A. Reid. U.S. Pat. 1,478,255.

Vaporising Apparatus.—H. F. Simon. U.S. Pat. 1,476,773.

Vaporiser.—H. F. Simon. U.S. Pat. 1,476,774.

Carburettor.—E. J. Simpson. U.S. Pat. 1,477,012.

Vaporiser.—M. O. Smith. U.S. Pat. 1,477,724.

Carburettor.—G. H. Taber. U.S. Pat. 1,480,748.

Gasoline Vaporiser.—J. Thrill. U.S. Pat. 1,480,032.

Carburettor Air Choke.—F. Underwood. U.S. Pat. 1,477,397.

Carburettor.—C. J. Voogtle. U.S. Pat. 1,478,152.

Vaporiser for Hydrocarbon Engines.—C. A. Wulf. U.S. Pat. 1,478,092.

14. Testing, Analysis and Apparatus.

Capillary Tube Viscosimeters.—G. Barr. *J. Sci. Instr.* **1**, 81. *J. Soc. Chem. Ind.* **43**, B116.

Note on the Lidstone Viscosimeter.—G. Barr. *J. Soc. Chem. Ind.* **43**, 29T.

A Reliable Plant Viscometer.—M. Marasco. *Ind. Eng. Chem.* **16**, 172.

A Reliable Apparatus for the Rapid Analysis and Regulation of Highly Viscous Substances.—G. F. Dierfield. *Chem. News* **127**, 228. *Chem. Abstr.* **18**, 183.

Analysis of Combustible Gases.—E. Hauser. *Bull. soc. chim.* **33**, 1141. *Chem. Abstr.* **18**, 320.

Dew Point a Volatility Test.—W. A. Gruse. *Petr. Age* **12**, (10), 20. *Chem. Abstr.* **18**, 324.

Tentative Method of Test for Colour of Lubricating Oils by Means of Union Colorimeters.—*Nat. Petr. News* **15**, (44), 87; (45), 45. *Chem. Abstr.* **18**, 325.

TENTATIVE METHOD OF TEST FOR STEAM EMULSIONS OF LUBRICATING OILS.—*Nat. Petr. News* **15**, (47), 51. *Chem. Abstr.* **17**, 325.

SOLVENT-INDEX OF REFRACTION METHOD OF DETERMINING OIL IN (PARAFFIN) WAX.—R. E. Wilson and R. E. Wilkin. *Ind. and Eng. Chem.* **16**, 9. *J. Soc. Chem. Ind.* **43**, B162. *Chem. Abstr.* **18**, 748.

AMERICAN SOCIETY FOR TESTING MATERIALS TENTATIVE STANDARDS, 1922.—*Chem. Abstr.* **18**, 429.

THE ESTIMATION OF TOTAL CARBON IN FUELS.—E. Goutal. *Fuel* **2**, 344. *Chem. Abstr.* **18**, 455.

THE SEPARATION OF UNSATURATED CONSTITUENTS FROM HYDROCARBON MIXTURES WITH BORIC ACID SOLUTION.—A. Jaeger. *Brennstoff-Chem.* **4**, 260. *Chem. Abstr.* **18**, 459.

WATER DETERMINATION ACCORDING TO MARCUSSON.—W. Normann. *Chem. Umschau* **30**, 249. *Chem. Abstr.* **18**, 1.

ASSAYS OF OFFICIAL AND OF LIQUID VASELINE, PARAFFIN AND PETROLEUM ETHER; ACTION UPON THESE OF CONCENTRATED, COLD SULPHURIC ACID.—F. Richard. *J. pharm. chim.* **28**, 209. *Chem. Abstr.* **18**, 149.

DETERMINATION OF THE CALORIFIC VALUE OF LIQUID FUELS.—N. Harwood. *Engineering* **116**, 396. *Chem. Abstr.* **18**, 158.

THE FLOW POINT OF OILS ACCORDING TO HOLDE.—R. Dittrich. *Z. deut. Oel-Fett-Ind.* **43**, 617. *Chem. Abstr.* **18**, 165.

VAPOUR PRESSURES OF GASOLINES AND LIGHT PETROLEUM NAPHTHAS.—F. H. Rhodes and E. B. McConnell. *Ind. and Eng. Chem.* **15**, 1273. *Chem. Abstr.* **18**, 583.

DETERMINATION OF UNSAPONIFIABLE MATTER IN GREASE AND OILS.—G. S. Jamieson. *Cotton Oil Press* **7**, (9), 40. *Chem. Abstr.* **18**, 595.

CHANGES IN SPECIFICATIONS FOR PETROLEUM PRODUCTS AND METHODS FOR TESTING AS APPLYING TO BUREAU OF MINES TECH. PAPER 323.—Recommended by the Technical Committee on Lubricants and Liquid Fuels and approved by the Federal Specifications Board.

THE TESTING OF PETROLEUM OILS FOR GASIFICATION.—A. Holmes. *Ind. and Eng. Chem.* **16**, 258.

DETERMINATION OF PARAFFIN OIL IN PHARMACEUTICAL PREPARATIONS.—J. Weichherz and Z. Klinger. *Chem.-Zeit.* **43**, 20. *J. Soc. Chem. Ind.* **43**, B232.

DETERMINATION OF THE VISCOSITY OF HIGHLY VISCOUS BODIES.—E. Berl, M. Isler and A. Lange. *Z. angew. Chem.* **37**, 128.

LABORATORY CONTROL WORK IS EXPLAINED.—W. E. Espy. *Oil and Gas J.* **23**, (6), 76. *Chem. Abstr.* **18**, 750.

COLOUR OF PETROLEUM AND ITS PRODUCTS.—R. Cross. *Oil and Gas News* **13**, (Nov.), 16.

DEW-POINT AND VOLATILITY OF GASOLINE.—W. A. Gruse. *Oil and Gas J.* **22**, (26), 86.

A New Comparison Apparatus for Colorimetric Determinations.—O. Mannebach. *Chem. Zeit.* **46**, 20.

Report of Sub-Committee VI on Colour.—*Nat. Petr. News* **15**, (44), 88.

The Fairweather Recording Gas Calorimeter.—J. W. Wood. Research Sub-Committee of the Gas Investigation Committee of the Institution of Gas Engineers. *Gas J.* **161**, 462, 524, 692, 766; **162**, 30, 106, 163, 222, 598, 677, 744; **163**, 102.

The Determination of Viscosity.—*Petr. World* (Los Angeles) **8**, (Nov.), 62.

Estimation of Ethylene and its Homologues in Primary Gas.—H. Tropsch and A. V. Philippovich. *Brennstoff Chem.* **4**, 147.

Patents.

Hydrometers.—M. E. Moeller. U.S. Pat. 1,473,309. *Chem. Abstr.* **18**, 344.

Separating Saturated from Unsaturated Hydrocarbons with Selenium Oxychloride.—V. Lenher. U.S. Pat. 1,473,350. *Chem. Abstr.* **18**, 401. *J. Soc. Chem. Ind.* **43**, B47.

Capillary Viscosimeter.—H. E. R. Vogel. U.S. Pat. 1,467,461.

Oil Tester.—O. B. Yetman and J. Leisure. U.S. Pat. 1,474,807.

15. Cracking and Hydrogenation.

The Economic Aspect of Cracking Oils.—C. M. Johnson. *Refiner. Oil Engineering and Finance* **4**, 507; **5**, 107.

The Gomory Cracking Process.—*Petr. Times* **11**, 208.

The Cracking Process of Burton.—H. I. Waterman and H. J. W. Reus. *Rec. Trav. Chim. des Pays-Bas* **43**, 87. *J. Soc. Chem. Ind.* **43**, B207.

Cracking or Making Your Oil Pay Dividends.—C. M. Johnson. *Ref. and Nat. Gas Mfr.* **2**, (10), 4. *Chem. Abstr.* **18**, 463.

Thermal Decomposition of Shale Oils under Pressure.—C. W. Botkin. *Railroad Red Book* **40**, 887. *Chem. Abstr.* **18**, 164.

Cracking of Mid-Continent Fuel Oil.—G. Egloff. *Oil and Gas J.* **22**, (19), 188. *Chem. Abstr.* **18**, 164.

Recent Observations on Distilling and Hydrogenating Tars and Oils.—F. Frank. *Petroleum* **19**, 907. *Braunkohle* **22**, 381.

Handling Heavy Oil with the Dubbs Process.—J. Morrell. *Ref. and Nat. Gas Mfr.* **2**, (10), 15.

A Belgian View of the Bergius Process.—*Petr. Times* **11**, 370.

Satisfied with Cross Unit.—*Petr. Age* **13**, (2), 26.

Another Cracking Process.—*Petr. Age* **13**, (2), 15.

Increasing the Production of Gasoline from California Petroleum.—R. Cross. *Oil Age* **20**, (6), 27.; **21**, (1), 24. *Chem. Abstr.* **18**, 749.

THE CRACKING OF CALIFORNIA KEROSENE DISTILLATE OIL.—G. Egloff. *Oil Age* **21**, (1), 22.

STUDY OF VISCOSITIES OF FUEL OIL MADE FROM PANUCO CRUDE.—R. H. Brownlee and W. H. Coburn. *Nat. Petr. News* **15**, (47), 81.

HOW THE HEAVY LONG BEACH RESIDUE IS BEING CRACKED TO PRODUCE HIGHER YIELDS.—G. Egloff. *Petr. World* (Los Angeles) **8**, (Nov.), 20.

U.S. REFINERIES USING CRACKING PROCESSES.—*Ref. and Nat. Gas Mfr.* **2**, (10), 13.

KENTUCKY OIL HAS BIG GASOLINE CONTENT.—G. Egloff. *Oil and Gas J.* **22**, (27), 76.

PATENTS.

METHOD FOR REFINING OILS.—W. J. Reilly. U.S. Pat. 1,479,833. *Petr. Age* **13**, (5), 52. *Ref. and Nat. Gas Mfr.* **3**, (2), 33. *J. Soc. Chem. Ind.* **43**, B210.

PROCESS OF CONVERTING OILS.—A. McD. McAfee, Assgn. to Gulf Refining Co. U.S. Pat. 1,482,438. *Petr. Age* **13**, (5), 52. *Ref. and Nat. Gas Mfr.* **3**, (3), 35.

PROCESS OF DISTILLING WITH CATALYTIC CHEMICALS.—G. L. Prichard and H. Henderson, Assgnrs. to Gulf Refining Co. U.S. Pat. 1,476,219. *Petr. Age* **13**, (4), 62. *J. Soc. Chem. Ind.* **43**, B85. *Chem. Abstr.* **18**, 583.

PROCESS AND APPARATUS FOR THE MANUFACTURE OF LOWER BOILING HYDROCARBONS FROM HIGHER-BOILING HYDROCARBONS.—A. M. McAfee, Assgr. to Gulf Refining Co. U.S. Pat. 1,467,091. *Ref. and Nat. Gas Mfr.* **3**, (1), 31. *J. Soc. Chem. Ind.* **43**, B85. *Chem. Abstr.* **18**, 583.

PROCESS OF OBTAINING A GASOLINE FROM HEAVY WASTE HYDROCARBONS AND NATURAL GAS.—W. Brink. U.S. Pat. 1,477,103. *Ref. and Nat. Gas Mfr.* **3**, (1), 31. *J. Soc. Chem. Ind.* **43**, B124.

OIL-CONVERTING APPARATUS FOR THE CONVERSION AND TRANSFORMATION OF OILS.—J. H. Adams, Assgr. to Texas Company. U.S. Pat. 1,477,860. *Ref. and Nat. Gas Mfr.* **3**, (1), 31. *J. Soc. Chem. Ind.* **43**, B124.

TREATING HEAVY VISCOUS PETROLEUM OIL.—E. M. Clark, N. E. Loomis and J. R. Carringer, Assgrs. to Standard Development Company. U.S. Pat. 1,478,102. *Ref. and Nat. Gas Mfr.* **3**, (1), 31. *J. Soc. Chem. Ind.* **43**, B165. *Chem. Abstr.* **18**, 751.

APPARATUS FOR AND METHOD OF CRACKING HYDROCARBONS.—F. E. Wellman, Assgr. to Kansas City Gasoline Co. U.S. Pat. 1,478,413. *Ref. and Nat Gas Mfr.* **3**, (1), 31. *J. Soc. Chem. Ind.* **43**, B166.

CONVERSION OF OILS INTO PRODUCTS OF LOWERED BOILING POINT.—A. McD. McAfee, Assgr. to Gulf Refining Co. U.S. Pat. 1,478,444. *Ref. and Nat. Gas Mfr.* **3**, (1), 33. *J. Soc. Chem. Ind.* **43**, B166. *Chem. Abstr.* **18**, 751.

Process to Convert Heavy into Lighter Hydrocarbons.—G. Egloff. U.S. Pat. 1,478,559. *Ref. and Nat. Gas Mfr.* **3**, (1), 33. *J. Soc. Chem. Ind.* **43**, B166.

Reduction or Hydrogenation of Organic Material (Coke, Peat or Petroleum).—F. Fischer and H. Schrader. Ger. Pat. 382,367. *J. Soc. Chem. Ind.* **43**, B84.

Process and Apparatus for Producing Hydrocarbon Compounds of Lower Boiling Point from those of Higher Boiling Point.—A. E. Alexander. From U.S. Gasoline Mfr. Corp. Brit. Pat. 207,276. *J. Soc. Chem. Ind.* **43**, B84.

Converting Heavy Hydrocarbons into Lower-boiling Products.—F. C. Thiele and C. Cordes. Ger. Pat. 379,895. *J. Soc. Chem. Ind.* **43**, B85.

Process and Apparatus for Cracking Oils.—J. F. Monnot. Brit. Pat. 208,310. *Chem. Age* **10**, 99. *J. Soc. Chem. Ind.* **43**, B124.

Dehydrating, Distilling and Cracking Tars and Oils.—T. O. Wilton and Wilton's Patent Furnace Co., Ltd. Brit. Pat. 200,933. *Chem. Abstr.* **18**, 323.

Cracking Hydrocarbon Oils.—R. W. Hanna. Brit. Pat. 199,766. *Chem. Abstr.* **18**, 326.

Cracking Hydrocarbon Oils.—Texas Co. Brit. Pat. 200,534. *Chem. Abstr.* **18**, 326.

Processes for Transforming Hydrocarbon Liquids into Liquids of Lower Boiling Point.—S. J. M. Auld. Brit. Pat. 208,569. *J. Soc. Chem. Ind.* **43**, B165. *Chem. Age* **10**, 99.

Process of Mixing and Delivering Oil and Aluminium Chloride.—G. H. King, Assr. to Gulf Refining Co. U.S. Pat. 1,478,438. *J. Soc. Chem. Ind.* **43**, B166. *Chem. Abstr.* **18**, 751.

Method of Cracking Oils.—J. G. Davidson, Assr. to C. H. Conner. U.S. Pat. 1,479,653. *J. Soc. Chem. Ind.* **43**, B166. *Ref. and Nat. Gas Mfr.* **3**, (2), 33. *Chem. Abstr.* **18**, 751.

Apparatus for Cracking and Distilling Oils.—J. G. Davidson, Assr. to C. H. Conner. U.S. Pat. 1,479,776. *J. Soc. Chem. Ind.* **43**, B166. *Ref. and Nat. Gas Mfr.* **3**, (2), 33.

Rendering Oils Non-sludging by Hydrogen Treatment.—H. R. Moody. U.S. Pat. 1,472,882. *Chem. Abstr.* **18**, 465.

Apparatus for Distilling and Cracking Petroleum.—J. L. Gray. U.S. Pat. 1,474,147. *Chem. Abstr.* **18**, 465. *J. Soc. Chem. Ind.* **43**, B47. *Petr. Age* **12**, (12), 72.

Converting Hydrocarbon Oils with Aluminium Chloride.—G. L. Prichard and H. Henderson. U.S. Pat. 1,473,316. *Chem. Abstr.* **18**, 466.

Cracking Heavy Hydrocarbon Oils.—D. W. Hoge. U.S. Pat. 1,474,475. *Chem. Abstr.* **18**, 583. *J. Soc. Chem. Ind.* **43**, B47.

Cooling Stills with Oil.—T. L. Watkeys. U.S. Pat. 1,476,744. *Chem. Abstr.* **18**, 584.

Method and Cracking Apparatus for Cracking Petroleum Products.—C. Kroll. Brit. Pat. 210,972. *Chem. Age* **10**, 276.

Manufacture of Liquid Fuel.—C. B. Byrnes. Brit. Pat. 209,128. *J. Soc. Chem. Ind.* **43**, B210.

Process of Producing Hydrocarbons of Relatively Low Boiling Point.—E. C. R. Marks. From Chemical Research Synd., Ltd. Brit. Pat. 210,131.

Conversion of Aromatic Ring Compounds into Motor Spirit.—A. S. Ramage. Can. Pat. 236,613.

Condensing Aluminium Chloride or other Hot Vapours.—K. P. McElroy. U.S. Pat. 1,478,750. *Chem. Abstr.* **18**, 751.

Method of Treating Hydrocarbons.—C. P. Dubbs. U.S. Pat. 1,484,445. *Ref. and Nat. Gas Mfr.* **3**, (3), 35.

Continuous Method of Cracking Hydrocarbon Oils.—E. O. Linton. U.S. Pat. 1,484,513. *Ref. and Nat. Gas Mfr.* **3**, (3), 35.

Process for Treating Hydrocarbons.—S. L. Gartlan. U.S. Pat. 1,484,612. *Ref. and Nat. Gas Mfr.* **3**, (3), 35.

Apparatus for Cracking Hydrocarbons and Recovering Gasoline.—M. H. Kotzebue and L. M. Bowman. U.S. Pat. 1,485,083. *Ref. and Nat. Gas Mfr.* **3**, (3), 35.

Method of and Apparatus for Hydrogenating Unsaturated Compounds.—C. M. Page. U.S. Pat. 1,472,281.

16. Insulating Oils.

Transformer Oil.—*Oil Engineering and Finance* **5**, 161.

17. Shale and Shale Oils.

American National Oil-shale Conference.—*Oil Engineering and Finance* **5**, 85.

Lias Shales of West Somerset.—E. H. C. Craig. *Oil Engineering and Finance* **5**, 85.

The Shale Oil Industry of New South Wales.—N. Waterhouse. *Oil Engineering and Finance* **5**, 86, 158.

The Oil Shales of Somerset.—A. Lidgett. *Petr. Times* **11**, 185.

The Shale Deposits of Sweden.—*Petr. Times* **11**, 210.

The Oil Shale Deposits of South Africa.—T. W. S. Hutchins. *Petr. Times* **11**, 232.

THE TECHNOLOGICAL VALUATION OF BROWN COALS AND OIL SHALES AS RAW MATERIALS FOR THE PRODUCTION OF CRUDE TAR.—E. Hentze. *Braunkohle* **22**, 433. *Chem. Abstr.* **18**, 318.

THE PRESENCE OF AN OIL SHALE RICH IN TAR IN GERMANY.—P. K. Breuer and H. Brocho. *Brennstoff Chem.* **4**, 200. *Chem. Abstr.* **17**, 324.

RESULTS OF ASSAYS OF THE NEW ALBANY OIL SHALE.—J. R. Reeves. *U.S. Bureau Mines Repts. Investigations* 2492. *Chem. Abstr.* **18**, 463.

THE UTILISATION OF NITROGEN CONTAINED IN RUSSIAN SHALES.—V. K. Valgio and M. Magurd. *Naphl. Slantz Khorj* **4**, (1), 88. *Fuel* **2**, 349. *Chem. Abstr.* **18**, 463.

THE OIL SHALE INDUSTRY. RÉSUMÉ FOR 1923.—*Petr. Times* **11**, 385.

USES OF WATER IN THE OIL-SHALE INDUSTRY WITH PARTICULAR REFERENCE TO ENGINEERING REQUIREMENTS.—J. J. Jakowsky. With a chapter on the Sanitation of Oil Shale Camps. A. L. Murray. *U.S. Bureau Mines Tech. Paper* 324.

THE OIL PRODUCTIVENESS OF ESTHONIAN SHALE.—*Petr. Times* **11**, 443.

OIL SHALE INDUSTRY.—L. C. Phipps. National Oil Shale Conference, Amer. Mining Congress. *Colorado School of Mines Quart.* **18**, (4), 43.

EXTENT AND IMPORTANCE OF OIL SHALE DEPOSITS IN UNITED STATES.—L. C. Phipps. *Min. Cong. J.* **9**, 405.

THE DESTRUCTIVE DISTILLATION OF OIL SHALE.—R. J. G. Stewart and J. Trenchard. *Colorado School of Mines Quart.* **18**, (3).

TEXAS ICHTHYOL DEPOSIT TO BE EXPLOITED BY DENVER CAPITALISTS.—*Eng. and Min. J.-Press* **116**, 813.

PRODUCTION OF LIQUID FUELS FROM OIL SHALE AND COAL IN AUSTRALIA.—R. E. Thwaites. *Inst. of Science and Industry, Melbourne, Bull.* 24.

A CHEMICAL EXAMINATION OF THE ORGANIC MATTER IN OIL SHALES.—R. H. McKee and R. T. Goodwin. *Colorado School of Mines Quart.* **18**, (1).

POSSIBILITIES FOR IMMEDIATE OIL SHALE DEVELOPMENT.—J. H. Ginet. National Oil Shale Conference, Amer. Mining Congress. *Colorado School of Mines Quart.* **18**; (4), 54.

OILSHALES COMMERCIAL TO-DAY.—H. McRae. *Mountain States Mineral Age* **8**, (Oct.), 27.

OIL SHALE—A COMPREHENSIVE SURVEY.—V. C. Alderson. *Colorado School of Mines Quart.* **18**, (4), 46.

POSSIBILITIES FOR IMMEDIATE OIL SHALE DEVELOPMENT.—J. H. Ginet. *Min. Cong. J.* **9**, 463.

THE FUNDAMENTALS OF SHALE.—D. D. Potter. National Oil Shale Conference, Amer. Min. Congress. *Colorado School of Mines Quart.* **18**, (4), 52.

MODIFIED SCOTCH TYPE IN ESTHONIA.—*Mountain States Mineral Age* **8**, (Nov.), 27.

OIL SHALE IN SANTA BARBARA COUNTY, CALIFORNIA.—F. D. Gore. *Mining in California* **19**, (Sept.), 211.

PATENTS

PROCESS FOR OBTAINING OILS FROM SHALES AND NON-CAKING COALS.—H. Edwards and G. Young. Brit. Pat. 207,073. *Chem. Age* **9**, 602. *J. Soc. Chem. Ind.* **43**, B84.

APPARATUS FOR COKING COAL, LIGNITE, SHALE OR OTHER BITUMINOUS MATERIALS.—K. P. du Loewenstein. Brit. Pat. 208,019.

PROCESS AND APPARATUS FOR EXTRACTING HYDROCARBON OIL MATERIAL FROM OIL-BEARING EARTHY MATERIAL.—D. T. Day. Brit. Pat. 208,586. *J. Soc. Chem. Ind.* **43**, B125. *Chem. Age* **10**, 99.

DISTILLING PLANT.—Plauson's (Parent Co.), Ltd. Brit. Pat. 198,705. *Chem. Abstr.* **18**, 301.

GASIFYING COMBUSTIBLE MATERIALS.—A. H. Pehrson. Brit. Pat. 202,625. *Chem. Abstr.* **18**, 323.

APPARATUS FOR EXTRACTING OIL FROM SHALE AND THE LIKE.—S.E. Co., Assees. of G. W. Wallace and D. J. L. Davis. Brit. Pat. 204,335. *J. Soc. Chem. Ind.* **43**, B165.

HORIZONTAL CYLINDRICAL RETORT FOR DISTILLATION OF SHALE, COAL AND OTHER MATERIALS.—C. M. Garland. U.S. Pat. 1,473,616. *Chem. Abstr.* **18**, 466. *J. Soc. Chem. Ind.* **43**, B8.

METHOD AND APPARATUS FOR EXTRACTING VOLATILE MATTER FROM OIL-BEARING SHALE AND THE LIKE.—A. L. Mond. Brit. Pat. 210,691. *Chem. Age* **10**, 250.

RETORT FOR SHALE DISTILLATION.—W. A. Lamb. U.S. Pat. 1,471,492. *Chem. Abstr.* **18**, 166. *J. Soc. Chem. Ind.* **42**, 1312A.

APPARATUS FOR DISTILLING HYDROCARBON OILS.—C. W. Thompson. U.S. Pat. 1,475,901. *Chem. Abstr.* **18**, 583.

APPARATUS FOR DISTILLATION OF BITUMINOUS MATERIALS.—M. Gercke. U.S. Pat. 1,474,357. *Chem. Abstr.* **18**, 584. *J. Soc. Chem. Ind.* **42**, 89.

DESTRUCTIVE DISTILLATION OF SHALE AND THE LIKE TO OBTAIN OIL THEREFROM.—S. G. S. Dicker. Brit. Pat. 211,033. *Chem. Age* **10**, 276.

APPARATUS FOR TREATING HYDROCARBON-CONTAINING MATERIALS.—C. P. Bowie and M. J. Gavin. U.S. Pat. 1,480,045. *J. Soc. Chem. Ind.* **43**, B209.

DECOLORISING CARBON FROM SHALE.—R. A. Demmo. U.S. Pat. 1,479,851. *Chem. and Met. Eng.* **30**, 441.

Shale Retort.—C. J. Dunton. U.S. Pat. 1,482,677. *Ref. and Nat. Gas. Mfr.* **3**, (3), 35.

Treatment of Oil Shale.—R. C. Dundas. U.S. Pat. 1,469,628.

18. Lignites and Coals and their Products.

Coal the Source of our Future Supplies.—*Petr. Times* **11**, 155.

Low Temperature Carbonisation.—A. McCulloch. Manchester College of Technology Evening Students' Chem. Soc. *Chem. Trade J.* **74**, 220.

New Methods of Investigation of Brown Coal.—W. Gothan. *Braunkohle* **21**, 400. *Chem. Abstr.* **18**, 211.

The Behaviour of Montan Wax on Dry Distillation.—J. Marcusson. *Z. angew. Chem.* **37**, 35. *J. Soc. Chem. Ind.* **43**, B162.

The Discovery of Niederlausitzer Cellulose of the Miocene Epoch.—G. Wisbar. *Braunkohle* **22**, 42. *Chem. Abstr.* **18**, 211.

The Problem of the Drying of Brown Coal.—K. Dummler. *Braunkohle* **22**, 497. *Chem. Abstr.* **18**, 318.

Low Temperature Carbonisation. Important Developments at Barnsley.—*Colliery Guardian* **126**, 907. *Chem. Abstr.* **17**, 320.

Using a Modified Mond Producer for Low Temperature Carbonisation.—C. D. S. Tupholme. *Chem. and Met. Eng.* **30**, 271.

Low Temperature Carbonisation.—S. N. Wellington and W. R. Cooper. C. Griffin and Co., Ltd., London.

Graded Temperature Zones in Coal Carbonisation.—C. H. S. Tupholme. *Chem. and Met. Eng.* **30**, 54. *J. Soc. Chem. Ind.* **43**, B161.

Manipulation of the Fischer-Schrader Aluminium Carbonisation Apparatus and Examination of the Distillation Products Obtained with It.—E. Noack. *Brennstoff Chem.* **5**, 17. *J. Soc. Chem. Ind.* **43**, B161.

Influence of Temperature on the Yield of Low Temperature Tar from Gas Coal.—H. Broche. *Brennstoff Chem.* **5**, 22. *J. Soc. Chem. Ind.* **43**, B161.

Coal and the Problem of Liquid Fuels.—E. Audibert. *Rev. ind. minérale* **1923**, 517. *Chem. Abstr.* **18**, 160.

The Low-temperature Carbonisation of Coal.—M. A. Martinez. *Revista minera. metalurgica ingeniera* **1920**, (2872). *Fuel* **2**, 276. *Chem. Abstr.* **18**, 160.

Carbonising Coal at Low Temperatures in the Fusion Retort.—C. H. S. Tupholme. *Chem. and Met. Eng.* **29**, 752. *Chem. Abstr.* **18**, 160.

THE MODIFICATION OF PRODUCERS TO OBTAIN LOW TEMPERATURE TAR.—A. Finkemeyer. *Feuerungstechnik* **11**, 187. *Chem. Abstr.* **18**, 162.

COAL DISTILLATION BY HIGH- AND LOW-TEMPERATURE PROCESSES.—W. H. Blauvelt. *Gas Age-Record* **53**, 3. *Chem. Abstr.* **18**, 577.

BERGIUS PROCESS FOR LIQUEFYING COAL.—*Iron Coal Trades Rev.* **107**, 735. *Chem. Abstr.* **18**, 578.

LABORATORIUMSBUCH FÜR DIE BRAUNKOHLENTEER-INDUSTRIE.—E. Graefe. W. Knapp, Halle (Saale).

UEBER EXTRAKTION UND DESTILLATION DER BRAUNKOHLE.—W. Knapp, Halle (Saale).

LOW TEMPERATURE CARBONISATION.—A. McCulloch. *Chem. and Ind.* **43**, 271.

METHODS OF TREATING PEAT AND LIGNITE.—M. Migeon. *Chim. et Ind.* **11**, 248.

THE LIGNITE DEPOSITS OF NIGERIA.—*Bull. Imp. Inst.* **21**, 325. *Chem. Abstr.* **18**, 650.

TERTIARY BROWN-COAL BEARING BEDS OF MOORLANDS.—D. Mawson and F. Chapman. *Trans. Proc. Roy. Soc. S. Australia* **46**, 131. *Chem. Abstr.* **18**, 650.

THE ESTIMATION OF VOLATILE MATTER AND OF COMBUSTIBLE MATTER IN LIGNITES.—M. Joseph. *Fuel* **2**, 373. *Chem. Abstr.* **18**, 743.

STUDY OF THE BEST TREATMENT OF LIGNITES TO RECOVER THE GREATEST VALUE FROM THEM.—J. Pieters. *Rev. Metal.* **20**, 386.

PATENTS.

CHLORINATED MONTAN WAX.—H. Stinnes. Brit. Pat. 199,073. *Chem. Abstr.* **18**, 339.

DISTILLING NON-COKING COALS.—H. Koppers. U.S. Pat. 1,480,271. *Chem. and Met. Eng.* **30**, 281.

PURIFYING WAXES.—E. von Boyen. Brit. Pat. 209,389. *Chem. Age* **10**, 251.

FUEL MIXTURE OF COAL AND OIL.—W. E. Trent. U.S. Pat. 1,479,757. *Chem. Abstr.* **18**, 747.

DISTILLING SOLID MATERIALS.—M. C. J. E. de Loisy. Brit. Pat. 210,402. *Chem. Age* **10**, 334.

19. PITCH, ASPHALT AND BITUMEN.

FURTHER NOTES ON THE CONSISTENCY OF ROAD TARS.—D. C. Broome. *J. Soc. Chem. Ind.* **43**, 25T.

The Bituminous Limestones of the Abruzzo. *Giorn. di Chimica Industriale ed Applicata* **5**, (Nov.). *Oil Engineering and Finance* **5**, 89.

The Constitution of Asphalt.—F. J. Nellensteyn. *Chem. Weekblad* **21**, 42. *J. Soc. Chem. Ind.* **43**, B162.

"Coorongite," a Petroleum Product.—E. de Hautpick. *Mining J.* **142**, 575. *Chem. Abstr.* **18**, 324.

Bituminous Sands of Northern Alberta.—S. C. Ells. *Petr. World* **21**, 152.

Good Roads with Asphaltic Oils.—*Min. and Oil Bull.* **9**, 1085.

Patents.

Roads, etc.—H. A. Mackay. Brit. Pat. 202,230. *Chem. Abstr.* **18**, 317.

Bituminous Emulsions.—H. A. Mackay. Brit. Pat. 202,021. *Chem. Abstr.* **18**, 326.

Bituminous Emulsions.—H. A. Mackay. Brit. Pat. 202,235. *Chem. Abstr.* **18**, 326.

Bituminous Paving Material.—W. T. Headley. U.S. Pat. 1,472,393. *Chem. Abstr.* **17**, 454.

(Asphalt) Emulsion and Process of Making Same.—L. Kirschbraun. U.S. Pat. 1,479,042. *J. Soc. Chem. Ind.* **43**, B210. *Chem. Abstr.* **18**, 742.

Binding Material for Use in Road Making and for Analogous Purposes.—J. F. Wake and D. D. Spence. Brit. Pat. 208,879. *J. Soc. Chem. Ind.* **43**, B219.

21. Origin of Petroleum.

A Study in Oil Deposits.—L. Balliet. *Oil Age* **20**, (4), 10. *Chem. Abstr.* **18**, 211.

Expounds Theory of Fish Origin of Oil.—J. M. McFarlane. *Oil and Gas J.* **22**, (21), 79. *Chem. Abstr.* **18**, 212.

Some Fish Story.—L. Balliet. *Oil and Gas J.* **22**, (24), 78. *Chem. Abstr.* **18**, 212.

The Stratigraphic and Regional Distribution of Petroleum with Regard to its Origin.—E. Pyhälä. *Petroleum* **19**, 1159. *Oil Engineering and Finance* **5**, 171.

The Genesis of Petroleum.—L. F. Balliet. *Oil Age* **20**, (6), 10; **21**, (1), 10. *Chem. Abstr.* **18**, 748.

Fishes, the Source of Petroleum.—J. M. MacFarlane. Macmillan and Co.

Heat and Pressure Conditions in Origin of Petroleum Oils.—L. Balliet. *Salt Lake Min. Rev. Oil and Gas J.* **22**, (21), 124.

22. Physical Properties of Petroleum and its Products.

Adsorption Theories.—*Chem. and Met. Eng.* **30**, 195.

Fluidity Anomalies in Refined Mineral Oils.—E. C. Bingham, W. L. Hyden and G. R. Hood. *Ind. Eng. Chem.* **16**, 25. *J. Soc. Chem. Ind.* **43**, B162.

The Solubility of Liquid Hydrocarbons in Superheated Water.—A. Jaeger. *Brennstoff Chem.* **4**, 259. *Chem. Abstr.* **18**, 459.

Properties of Paraffin-containing Petroleum Products.—L. Gurvich. *Petroleum* **19**, 183. *Chem. Abstr.* **18**, 164.

The Theory of Emulsification.—P. Finkle, H. D. Draper and J. H. Hildebrand. *J. Amer. Chem. Soc.* **45**, 2780. *Chem. Abstr.* **18**, 607.

The Interfacial Tension between Petroleum Products and Water.—E. M. Johansen. *Ind. Eng. Chem.* **16**, 132. *Chem. Abstr.* **18**, 748.

The Physical Properties of the Paraffin Hydrocarbons.—R. E. Wilson and W. H. Bahlke. *Ind. and Eng. Chem.* **16**, 115. *Chem. Abstr.* **18**, 748.

Oil Flow-viscosity and Heat Transfer.—R. S. Danforth. R. S. Danforth, San Francisco, California.

Conversion Tables for Petroleum.—*U.S. Bureau Standards Letter Circular* 89.

Petroleum Tables.—*U.S. Bureau Standards Letter Circular* 101. *U.S. Bureau Standards Tech. Paper* 77 and *Circ.* 77.

Vapour Pressures of Gasolines and Light Petroleum Naphthas.—F. H. Rhodes and E. B. McConnell. *Ind. Eng. Chem.* **15**, 1273. *J. Soc. Chem. Ind.* **43**, B120.

Variation of Viscosity (of Lubricating Oils) with Temperature.—K. Konig. *Z. angew. Chem.* **37**, 8. *J. Soc. Chem. Ind.* **43**, B121, 208.

23. Chemistry of Petroleum.

The Colloid Chemistry of Petroleum.—*Petr. Times* **11**, 242.

Some Characteristics of the Hydrocarbons in Mid-Continent Kerosene.—C. R. Wagner. *Ind. and Eng. Chem.* **16**, 135. *Ref. and Nat. Gas. Mfr.* **3**, (2), 9. *Chem. Abstr.* **18**, 749. *Petr. Age* **13**, (4), 26.

Petroleum as a Chemical Raw Material.—B. T. Brooks. *Ind. and Eng. Chem.* **16**, 185.

The Lubricant and Asphaltic Hydrocarbons in Petroleum.—C. F. Mabery. *Ind. Eng. Chem.* **16**, 207.

Catalysis as Related to Petroleum.—*Petr. Times* **11**, 264.

The Combustion of Methane to Formaldehyde.—H. Tropsch and O. Rœlen. *Brennstoff Chem.* **5**, 37. *J. Soc. Chem. Ind.* **43**, B232.

THE OXIDATION OF UNSATURATED HYDROCARBONS WITH OZONE.—R. Koetschau and W. Flemming. *Z. angew. Chem.* **37**, 42. *J. Soc. Chem. Ind.* **43**, B210.

CONTRIBUTION TO THE STUDY OF THE CHLORINATION OF METHANE.—H. Gault. *Les Matières Grasses* **15**, 6562, 6592, 6624, 6691.

THE CHEMICAL NATURE OF NAPHTHENIC ACIDS.—Parts I and II. N. Zelinsky. *Ber.* **57**, 42.

METHANOL EXTRACTIONS OF MINERAL OILS.—H. Stäger. *Helv. Chim. Acta.* **6**, 893. *Chem. Abstr.* **18**, 164.

OXYGEN-OIL EXPLOSIONS. PRELIMINARY REPORT III. SPONTANEOUS IGNITION OF OILS IN OXYGEN UNDER PRESSURE.—S. H. Brooks. *U.S. Bureau Mines Repts. Investigations* 2555.

THE COMPOSITION OF NATURAL GAS GASOLINE.—R. P. Anderson and A. M. Erskine. *Ind. and Eng. Chem.* **16**, 263.

THE OXIDATION OF LIGNITE GAS OIL WITH OZONE.—F. Evers. *Z. angew. Chem.* **37**, 116.

CHEMICAL COMPOSITION OF HIGH-BOILING MINERAL OILS.—J. Marcusson. *Mitt. Materialprüfungsamt* **40**, 308. *Chem. Abstr.* **18**, 748.

STUDIES ON NAPHTHENIC ACIDS. III. NAPHTHENIC ACIDS FROM KUBIKI KEROSENE DISTILLATE.—Y. Tanaka and S. Nagai. *Kôgyô-Kwagaku Zasshi* (*J. Chem. Ind. Japan*) **26**, 1115. *J. Soc. Chem. Ind.* **43**, B121.

PATENTS.

PROCESS FOR CONVERTING UNSAPONIFIABLE HYDROCARBONS INTO FATTY ACIDS AND OTHER SAPONIFIABLE PRODUCTS.—"Kliva" Ges. m.b.H. chem. Prod. Ger. Pat. 382,496. *J. Soc. Chem. Ind.* **43**, B102.

PROCESSES OF DEHYDROGENATION IN THE PRESENCE OF CATALYSTS.—J. K. Pfaff and R. Brunck. *Ber.* **56**, 2463. *J. Soc. Chem. Ind.* **43**, B120.

SULPHO-COMPOUND AND ITS PRODUCTION (FROM MINERAL OILS).—E. M. Johansen, Assr. to The Atlantic Refining Co. U.S. Pat. 1,477,829. *J. Soc. Chem. Ind.* **43**, B124.

CATALYTIC OXIDATION OF ORGANIC COMPOUNDS.—Hadische Anilin-und Soda Fabrik. Brit. Pat. 199,886. *Chem. Abstr.* **18**, 274.

ALCOHOL; ETHYL HYDROGEN SULPHATE.—Compagnie de Béthune. Brit. Pat. 199,007. *Chem. Abstr.* **18**, 274.

HYDROCARBONS.—Soc. Ricard, Allenet et Cie. Brit. Pat. 202,311. *Chem. Abstr.* **18**, 275.

24. OIL GAS AND PETROL GAS.

RELATION OF OPERATING PRACTICE TO COMPOSITION OF LIGHT OIL FROM CARBURETTED WATER GAS.—R. L. Brown, E. F. Pohlman and H. G. Berger. *U.S. Bureau Mines Repts. Investigations* 2537. *Chem. and Met. Eng.* **30**, 273.

25. Miscellaneous.

Petroleum.—M. Haney. *Sci. Monthly* **17**, 548.

The Preparation of Synthetic Oil Mixtures (Synthol) from Carbon Monoxide and Hydrogen.—F. Fischer and H. Tropsch. *Brennstoff Chem.* **4**, 276. *Chem. Abstr.* **18**, 459.

Petroleum and Natural Gas.—L. J. Jones. *Petr. Times* **11**, 380, 423, 461.

The Petroleum Register, January, 1924, Edition.—*Oil Trade J.*, New York.

The Story of Oil.—*Scient. American* **129**, 256.

Preparation of Petroleum from Vegetable Oils.—A. Mailhe. *Compt. rend.* **177**, 202.

Oil now Used for Radiator solution.—*Oil and Gas J.* **23**, (1) 82.

When Drake Discovered Oil.—*The Lamp* **6**, (Oct.), 19.

Selective Flotation a Feature at the Magistral-Ameca Plant.—H. M. Payne. *Eng. and Min. J. Press* **116**, 1105.

Eight Billion Gallons Estimated as 1924 Gasoline Consumption.—J. C. Chatfield. *Nat. Petr. News* **15**, (51), 37.

Statistics now Big Factor in Success. A. V. Borque. *Oil and Gas J.* **22**, (26), 90. *Nat. Petr. News* **15**, (47), 23. *Nat. Gas.* **4**, (Dec.), 27.

Fuller's Earth in 1922. J. Middleton. *Mineral Resources of the United States*, 1922. Part II, 69.

Simplified Book-keeping as Worked out by Eastern Jobbing Concern. —*Nat. Petr. News* **15**, (22), 21.

Patents.

Formation of Artificial Petroleum from Squalene and Cholesterol. —S. Kawai and S. Kobayashi. *Kôgyô-Kwagaku Zasshi* (*J. Chem. Ind. Japan*) **26**, 1036. *J. Soc. Chem. Ind.* **43**, B121.

Water-soluble Oils.—H. W. Hutton. Britt. Pat. 202,401. *Chem. Abstr.* **18**, 338.

Abstracts.

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General.

Getting the Most out of Mexican Crude. (Part II.) F. N. Williams, Refiner and Natural Gasoline Manufacturer. 1924, 3. No. 2, 15–28. (Part I., *Journ. Inst. Petr. Techn.*, 10, 41, p. 38 A.)

The first article dealt with the distillation and analysis of the oil; the present deals with refining. In purifying with sulphuric acid colloidal colouring matter, nitrogen, sulphur and oxygen compounds are partially removed. The distillates contain sulphur in different combinations, whilst the light gases are highly saturated with H_2S, which is removed in wet scrubbers before storing the gas. Steam in the stills helps to remove some impurities. The most important point in refining the naphtha fractions is that the distillates should not be treated when fresh, especially the cracked portions from the re-running of the gas oil and heavier fractions. Before treatment these naphthas should be allowed to age in order that the resinous matter may have time to coagulate and precipitate. If this is not done very heavy treatment with sulphuric acid and redistillation is necessary, and even then sulphonated hydrocarbons distil over and the gasoline soon goes off colour and deposits a resinous material. Excessive losses also take place owing to the prolonged agitation necessary, and also on account of polymerisation of light unsaturated hydrocarbons to high boiling compounds. After suitable ageing the naphtha is treated with 2·5 lbs. sulphuric acid per barrel, and after washing with water is agitated with once used Doctor solution and flowers of sulphur followed by half a gallon per barrel of fresh Doctor with 40 lbs. of sulphur. A final water wash completes the operation. The kerosene fraction requires very heavy treatment with acid to obtain a first-class burning oil, 20 lbs. of fuming sulphuric acid per barrel being employed for the first wash, followed by 16 lbs. of 66° Bé acid and water and "Doctor" treatment. Even so, the deposit on lamp chimneys is heavy and can only be cured by further distillation and subsequent filtration through fuller's earth. Kerosene from the steam still naphtha bottoms is improved in yield from 65 to 95 per cent. by redistilling over 2 per cent. of 30° Bé caustic soda solution, which also enables the acid treatment to be reduced from 15 to 10 lbs. per barrel. The heavy oil and paraffin fraction should be treated with acid before pressing, in order to lighten the work of the presses; 6–8 lbs. of 60° acid per barrel is given, and after settling the oil is transferred to a washer with the cone already filled with water. This procedure prevents fine acid sludge from sticking to the cone. The water is drawn off and the oil now sprayed with warm water at 100°–120° F., and allowed to stand an hour

before drawing off. Neutralisation is done with ·25 gallons of 6° Bé caustic soda per barrel, and treatment completed with a water wash at 160° F. Red lubricating oils are first treated with 5 lb. of 66° acid per barrel for drying purposes, and a long settling of 4 to 6 hours is necessary before drawing off sludge; 6 lb. of acid is next given and the sludge broken out with water. The oil is then transferred to another washer and neutralised with 3° Bé caustic soda, which is added when half the oil has been transferred. Soap solution is sometimes added to prevent emulsification, and in this case hot water is added and live steam applied until the proper reaction is noted. After settling the oil is air blown until bright. Silica gel has been successfully employed for refining Mexican naphthas, the sulphur content being in some cases reduced to 0·005 per cent. Certain types of fuller's earth also give good results, a good coloured lubricating oil being obtained by the application of 1 ton of earth to 4 tons of oil. The yields from Mexican crude without the use of cracking stills is as follows:—Gasoline 18·4 per cent., kerosene 7·5 per cent., gas oil 51·1 per cent., coke 16·1 per cent., gas and loss 6·8 per cent. With cracking stills the yields are:—Gasoline straight 18·4 per cent., cracked 21·5 per cent, kerosene 7·5 per cent., fuel oil 26·1 per cent., coke 16·2 per cent., gas and loss 10·4 per cent. Mexican gas oil compares favourably with Mid-Continent gas oil for making carburetted water gas. The fuel oil, being very heavy, contains more B.T.U. per gallon than most. It should be heated to vaporising point when being used in order to obtain the full heating value. Many tables of distillations, gravities, etc., are included in the original paper. F. G. P. R.

PETROLEUM AS A CHEMICAL RAW MATERIAL.—B. T. Brooks. *Journ. Ind. Eng. Chem.* Vol. 16, 2, pp. 185-9.

The paper gives a general survey of organic chemistry as applied to petroleum, discusses the many problems, and outlines the possibilities that may be expected from petroleum as a raw material. Although considerable research work has been done in connection with refinery practice, the purely chemical side has received little attention as compared with coal tar and other organic industries. This in the opinion of the author is due partly to the fact that most of the useful products exist in the crude and are not treated as raw material for chemical action, and for the more potent reason that there is a lack of systematic knowledge of the non-benzenoid hydrocarbons. Such work is admittedly full of great difficulties, but the importance of the petroleum industry should make it worth while, apart from the academic knowledge to be gained. The isolation of those hydrocarbons composing the lighter fractions reveal the complexity of the many different crudes, and in conjunction with the tedious method of fractional distillation the author advocates synthesis particularly of the isomer compounds of which so little is known. The study of the unsaturated hydrocarbons in general is one of pressing importance having regard to their presence in cracked spirits and lubricating oils. It is suggested that many of the undesirable properties of these products are not due to unsaturated compounds as is generally supposed, and Dunstan and Thole have shown that such hydrocarbons are of value in lubricating oil. Further, that sulphuric acid may not always be regarded as a useful refining agent. Hypochlorous acid and liquid sulphur dioxide are instanced as more useful agents and also are a means of producing alcohols and other commercially useful products. The preparation of chlorhydrins from petroleum has been accomplished, and the reaction of nitroso chloride

in producing ketones opens up many possibilities of new products. Drying oils of the nature of linseed oils may be made from chlorinated kerosene and resins from the gumming constituents of solvent spirits. Even those impurities occurring as minor constituents, which at present are regarded as a nuisance—*e.g.*, nitrogen and sulphur compounds—may find useful application, ichthyol having been prepared from sulphonated shale oil. S. B.

THE INTERFACIAL TENSION BETWEEN PETROLEUM PRODUCTS AND WATER.—E. M. Johansen, *Ind. Eng. Chem.*, 16, 2, pp. 132-4.

The author has made a large number of interfacial tension determinations between various products and water, and shows how this little used constant can often give valuable information. The drop method was used in these experiments, at first with a Donnan pipette, then later with two different types of apparatus devised by the author for use with transparent and non-transparent oils respectively. The first consisted of two super-imposed bulbs connected by a capillary tube, the upper bulb containing water and the lower bulb the oil. The lower plane of the capillary tube is carefully determined and the water allowed to drop through the oil at a definite slow rate by means of a stop-cock attached to the upper bulb. When a measurable quantity of water has collected in the lower bulb it is drawn into a graduated receiver and the average volume per drop calculated. The second apparatus was of somewhat similar design but so arranged that the drops of oil rose through the water by means of applied suction and the volume of each drop ascertained as before. Both types were fitted to water bath temperature control. The interfacial tension between a number of representative petroleum products and water are given. These show close agreement between the two types of apparatus except in the case of those oils containing a water soluble constituent. It is in this connection that the interfacial value showed the effect of minute traces of substances that are adsorbent at the interface. An oil containing a trace of organic acid will show a much lower value than the same oil without the acid, the difference being even more marked when dilute alkali is used instead of water. The method was also successful in detecting xylene in an oil when the quantity was too small for ordinary methods. Interfacial tension is found useful in problems of lubrication, emulsions, the refining of oils with acid and the crystallisation of wax, and likely to find a much wider scope of employment. S. B.

EMPIRE OIL: THE PROGRESS OF SARAWAK.—Hon. T. G. Cochrane, *Journ. Roy. Soc. Arts*, LXII., 3723, pp. 308-319, 1924.

The paper is an amplification of "Sarawak, its resources and trade," by E. Parnell (*Royal Soc. Arts*, April 11, 1923), in which only brief mention was made of the petroleum industry. In 1923 production reached 560,000 tons, being second only to Burma, which is the largest producer within the British Empire. Oil seepages were known for years in the neighbourhood of the Baram and Miri rivers, and were exploited in a primitive way by the natives, who used the raw oil for lighting and the bituminous residue for caulking their dugouts. In 1904 the Anglo-Saxon Petroleum Company obtained a concession from the Rajah of Sarawak—Sir Charles Brooke—and had the ground examined geologically by Dr. J. T. Erb, who reported the existence at Miri of a dome-shaped, unsymmetrical anticline. The terms of the concession stipulated that 10,000 tons of fuel oil should always be held in store at Miri for the

sole use of the Navy of Great Britain or her colonies, a very wise and patriotic measure. In February, 1910, the location of the first well was decided, and in March Mr. McAlpine commenced getting together materials and labour for drilling. This work was very difficult, owing to the remote position of Miri, the bad coast, and a very shallow bar at the mouth of the river. However, in six months all material had been landed without mishap. The first site was located a mile from the landing place and 260 feet above sea-level, and two months after drilling commenced oil was struck at 447 feet with a production of 4 tons per day. Owing to stormy weather and the non-arrival of the usual steamer, Mr. Souter volunteered to walk 90 miles to a cable station to get the news home. A second well was commenced in 1911, and during that year production was about 260 tons. In 1912 drilling was only moderately successful and the production was 5635 tons, but a distillery was constructed from old steel drums and benzine of 0·760 sp. gr., kerosene and a fuel oil of 0·900 sp. gr. was produced for local use. In 1913 no very good wells were opened in the Miri field itself, but in a northerly extension well No. 8 came in at 1402 feet with 80-100 tons a day. On April 18th of this year the first shipment of oil was made in two lighters. During 1914 no large producers were struck, but the production reached 64,510 tons for the year. In August the first attempt was made to lay a submarine pipe-line for loading tankers. To get a depth of 24 feet at low tide a pipe 13,500 feet long was required, and this had to be floated out in three sections, since no level ground of this length existed on which to construct the pipe. Owing to a sudden gale during the floating out operation only two sections were in place and had to be sunk, but in spite of only 18 feet of water at the sea end and frequent breakages of the flexible hose 22,753 tons of oil was loaded into tankers during the year. In 1916 a Trumble topping plant of 500 tons a day capacity was installed for the production of Navy fuel oil, but as no tankers were available during the war to remove the light distillates these were pumped back into the ground down old wells to the extent of 30,000 tons, of which it is estimated that 14,000 were recovered in 1919. At the end of 1915 the old 6-inch submarine pipe line was in such bad condition that it was decided to lay a new 8-inch line, which was done at Lutong, seven miles away, being the nearest available stretch of level ground for construction. The line was 11,750 feet long and was successfully launched without accident. During 1919, 1920, 1921, 1922 and 1923 production showed increases over the preceding years of 13,000, 60,000, 58,000, 204,000 and 150,000 tons respectively. Geological data now at hand show that three anticlines exist, with a N.E.—S.W. strike, more or less in echelon. All recent wells vary from 1000 to 2000 feet, but at Pujut a shallow field of 300-400 feet yields natural fuel oil with no constituents boiling below 200°C. Wells in the Miri field have generally a long life with a slow fall off in production after the first year. The present refinery at Lutong comprises two Trumble units handling 1500 tons per day. The properties of Sarawak crude were described by Mr. J. Kewley (*Journ. Inst. Petr. Techn.*, **10**, 41, pp. 42-50). The sea loading lines are the longest in the world and are as follows :—No. 1, 11,750 feet (launched 1916); No. 2, 13,000 feet (launched 1919); No. 3, 14,500 feet (launched 1921); and No. 4, 14,510 feet (launched 1923). The whole pipe is first put together on trolleys running on a light railway. The pipe is then coated with bitumastic, wrapped with felt and lengths of palm bound on by wire rope, all well coated with bitumen. The sea end is then attached by hausers to tugs, which drag the whole train out to

sea at an average pace of just over 3 knots per hour. The total weight of the whole line ready for launching was 230 tons. Very elaborate precautions are taken for keeping the line straight, and signals and telephones connect up the whole 2 miles of line. Construction of the pipe and runway takes many months, but the actual launching less than an hour. Flexible hose 120 feet in length connects the sea end with the tankers, 115 of which were loaded without mishap during 1923. The rate of loading through 8-inch lines is 190 tons of fuel oil, 150 tons of kerosene, and 140 tons of benzine per hour. The total oil thus loaded in 1923 was 530,000 tons. The European staff now numbers 133, with 190 senior Asiatic staff and 3252 coolies. Miri itself is no longer a primitive native village but possesses all the refinements of Western civilisation.

F. G. P. R.

THE THEORY OF EMULSIFICATION.—P. Finkle, H. D. Draper and J. H. Hildebrand. *J. Amer. Chem. Soc.*, 1923, **45**, No. 12, 2780–8.

To disperse one liquid in another in the form of an emulsion requires the doing of work upon the system equal to the product of the interfacial tension multiplied by the increase in surface. An emulsion of two pure incompletely miscible liquids is therefore always unstable and requires a suitable third substance to stabilise it, but so far no altogether satisfactory method is known by which to predict the relative powers of different emulsifying agents either to stabilise the emulsions or determine which of the two liquids shall be dispersed in the other. The authors give several rules propounded by others as the result of experience, and then elaborate an hypothesis of their own to account for the behaviour of all emulsifying agents. Rayleigh showed that a film is stabilised by the addition of some substance which by virtue of high adsorption at the surface greatly lowers the surface tension. Thus soap stabilises the water films between bubbles in soapsuds, as well as promoting a stable water-oil emulsion. A difficulty, however, arises when considering the soaps of the alkalis compared with those of the heavier metals, since adsorption and lowering of the interfacial tension occur in both cases, and either an oil or a water film might be stabilised. Bancroft considers that the enclosing liquid will be the one in which the emulsifying agent is the more soluble, since the surface tension on that side of the film will thereby be lowered and the film will tend to curve towards and enclose the other liquid. Langmuir has, however, proved that the emulsifying agent may form films at the interface only one molecule thick, and therefore it is difficult to imagine different tensions on the two surfaces of an interface. The general rule that the external phase is the one that is the best solvent for the emulsifier is, however, undoubtedly true in most cases. Bhatnagar gives, from experimental data, the rule that "all emulsifying agents having an excess of negative ions adsorbed on them and wetted by water will yield oil-in-water emulsions, while those having an excess of adsorbed positive ions and wetted by oil give water-in-oil emulsions." Langmuir suggested that the direction of curvature of the interface was due to the orientation of the molecules therein, which also affords an explanation of the mechanism by which colloids are formed. Thus oleic acid molecules covering water containing sodium hydroxide adsorbs OH groups on to the COOH radicles, thereby causing the lower side of the film to expand and bulge downwards in spots, so that it finally detaches itself in the form of particles, the outer surface consisting of COOH groups with adsorbed OH, and the inner of long hydrocarbon chains. The size of the colloid particles depends on

the difference in size between the two ends of the molecules. This theory can be tested with soaps and two liquids, water and one having a low polarity such as benzene, where the interfacial film would probably be but one molecule thick, having the non-polar hydrocarbon chain in the benzene and the polar metallic end in the water. If both ends are packed as close as possible it is obvious that the film will curve towards that end of the molecule having the smaller volume, as would be exemplified by a row of tadpoles lying head to head and tail to tail, where the tails would form the concave side of the curve. Thus the direction and degree of curvature should vary with the atomic volume of the metal and with the number of hydrocarbon chains attached thereto—*i.e.*, with the valency. The following elements Cs, K, Na, Ag, Ca, Mg, Zn, Al and Fe in the form of their stearates and oleates were employed for testing the theory, it being expected that the larger the size of the metallic atoms the greater would be the curvature of the film, and consequently the more stable the emulsion. The soaps of Cs, K, Na, Ag, being more soluble in water than benzene, will form emulsions of oil in water, the stability of which should be in the same order as their atomic volumes, which are 70·6, 45·3, 22·9 and 10·3. The divalent metals Ca, Mg and Zn should have much less ability to emulsify oil in water with atomic volumes 12·6, 7·0 and 4·6, whilst the trivalent Al and Fe—atomic volumes 3·4 and 2·3—being more soluble in benzene than in water will form water in oil emulsions. The relative size of the drops formed should also vary inversely with the atomic volumes of the metals, according to the packing theory above. All this was proved true experimentally. The life of the emulsions was Cs—8 weeks, K—8 weeks, Na—6 weeks, Ca—1 hour, Mg—2 days, Zn—24 days, Al—7 days, Fe—10 days; whilst the size of the drops measured under the microscope was found to be smallest with Cs soap, and increased with decrease in the atomic volume of the soap employed. A theory is also put forward to explain the ability of many powdered solids to stabilise emulsions. The powder must be at the interface and be wetted by both liquids; in general one liquid will wet the solid better than the other, so that the particles will be drawn more largely into the former. If there are sufficient particles to fill the interface the tendency of the interface to contract will cause it to bend in the direction of the more poorly wetting liquid, which thus will become the enclosed phase. Thus by observing the angle of contact which the interface makes with a solid particle it should be possible to predict whether the solid is capable of forming a stable emulsion, and if so which liquid will be the dispersed phase. Unless the angle is 90°, in which case no emulsion will be formed, the interface will be on one side or the other of the points of contact of the particles, and its tension will cause the film to be concave on that side on which the angle of contact between the interface and the particle is the greater. This was confirmed by a microscopic examination of an emulsion of water in benzene stabilised by lamp-black. It is suggested that the same theory explains the Bancroft rule that a colloid emulsifier causes the phase in which it is soluble to be external. F. G. P. R.

METHOD OF DECREASING EVAPORATION LOSSES OF PETROLEUM.—J. H. Wiggins. *U.S. Bureau of Mines, Bulletin* 319, 1923. (*cf.* J. 1922, 33. 547–548).

Under present conditions in the Mid-Continental field 6·5 per cent. of the oil produced is lost by evaporation; 3·5 per cent. on the lease, and

3 per cent. in transportation. In experiments conducted on a lease at Oklahoma, with a volatile crude oil of about 40°B., during five days filling into a tank with sheet steel roof, open 18-in. manhole, and two open 8-in. gauge holes there was a loss of 5·97 per cent. In filling into a tank with similar roof, the seams packed with gaskets, and a 4-in. vent pipe from centre, the loss was 2·55 per cent., and in filling into a tank with all openings approximately sealed, pressure during filling being relieved by an automatic pressure regulator, the loss was 2·03 per cent. The losses in the above tanks while standing full for five days were 4·0 per cent., 1·26 per cent. and 0·79 per cent. respectively. The loss in 17 days from a so-called empty tank (containing 10 ins. to 18 ins. of oil) was, for the open tank mentioned, 8·4 per cent., and for the third "small vent" tank 6·0 per cent. The fraction so lost from the open tank was much less volatile than that from the small vent tank. The same oil when passed through a flow tank lost 2·3 per cent., and subsequently in filling (1·1 to 1·9 days), 1·42 per cent. from open tank, 1·17 per cent. from 4-in. vent tank, and 0·10 per cent from the third tank, made still more nearly tight (pinhole vent tank). The loss on standing for 12 days was 5·35 per cent., 1·21 per cent. and ·26 per cent. respectively for the three tanks under summer conditions. The cost of making a 2000-barrel tank gas-tight is about $450. The losses in above experiments were calculated from the gravity and distillation tests of the oil. In further experiments on a lease producing 265 barrels of 34·9°B. oil daily 4·44 per cent. was lost with the ordinary tank equipment, and only 0·58 per cent. with gas-tight equipment. In another case an ordinary stock tank of 250 barrels capacity was filled during 20 days with a loss of 9·1 per cent., and an increase in gravity of 3·4°B. An installation for gas-tight handling of crude oil consists of a 1000-barrel steel flow tank, kept at a pressure of 6 oz. per sq. in. above atmosphere, from which gas is taken by a 10-in. pipe to a gasoline compression plant. The stock tank is kept under a vacuum of 1 in. of mercury, and also connected with gasoline plant. The gasoline plant serves several units of one or more wells. The amount of gasoline evaporated and recovered varied almost proportionally with the atmospheric temperature. By this system, in summer, some 5 per cent. is taken out of the crude and recovered as gasoline, and the loss in pipe-line transport is kept down. When the crude contains emulsified water, and is heated in a dehydration tank, a condensation plant may be installed to recover the evaporated gasoline. In such a case gasoline amounting to 1·36 per cent. on the crude was recovered. Trunk-line losses in gathering tanks are caused by the "breathing" of the mixture of oil and vapour above the oil from thermal changes, and by the intake and driving out of air when the tank is emptied and refilled. These losses depend on the temperature of the liquid surface, the vapour pressure of the liquid, the variation in temperature by day and night, the times the tank is filled and emptied, and the fullness of the tank when standing. The amount of "breathing" is influenced by the painting in different colours of the tanks, as a white-painted tank kept the oil 8°F. cooler than that in a black-painted tank in summer. The best insulation proved to be little more valuable in this respect than white paint. It has been proposed to use floating roofs to tanks to prevent the contact of air with the oil, but such have not been tried on a large scale. Details of methods of sampling and testing are given, with numerous diagrams and illustrations. It is considered that an installation of tight tanks should pay for itself in about 100 days. The retaining of the light fractions in the oil at the leases increases the

liability to loss in pipe-line transport, as then a lighter product is dealt with; whereas the installation of a gasoline plant leads to the recovery of a valuable product and leaves no greater liability to loss in transport.
H. M.

THE ADSORPTION OF BINARY MIXTURES BY ANIMAL CHARCOAL AND A COMPARATIVE STUDY OF THE ADSORPTIVE POWER OF DIFFERENT VARIETIES OF CHARCOAL.—*N. A. Yajnik and T. C. Rana. J. Physical Chem.*, 1924, **28**, No. 3, 267–278.

Although this work was not carried out on oils the scientific study of adsorptive materials and the mechanism of filtration is of such importance to the oil industry that any contribution to this subject is of interest to those engaged in the study of oils. Up to the present the investigation of the adsorption of mixtures has been practically neglected, nearly all work having been confined to single substances in solution. Pure animal charcoal was washed with a mixture of HCl and HNO_3 and freed from acid by washing in distilled water. It was then dried, powdered and sieved to a uniform mesh. The chlorides of Na, K, Li, Mg, Ba, and Ca as well as KOH, NaOH, HCl, HNO_3, $(COOH)_2$, Na_2CO_3 were employed in the adsorption experiments, which consisted of agitating 2 gms. of charcoal with 25 c.c. of a solution of one or two of the above compounds for 20 minutes. Estimations of the concentration of the solution before (C_1) and after (C_2) treatment gave the amount adsorbed (A), the relative adsorption being obtained from the formula $(A \times 100)/C_1$. The effect of temperature changes was first studied at 25°, 50°, 75° and 100° C. and found to be extremely small, with slight increase of adsorption with rise in temperature, but of so small a degree as to render the use of a thermostat unnecessary during the progress of the work. Change in concentration of single solutions, however, had a marked effect on adsorption. With increase in dilution the relative adsorption increases, but at high concentrations the absolute amount adsorbed is greater than at lower concentrations. The chemical nature of the substance in solution has some effect on adsorption, the chlorides of Na, K, Li, Mg—which all belong to the same periodic group—having lower adsorption values than $SrCl_2$ or $CaCl_2$. In the study of binary mixtures it was found that the presence of a foreign substance may have no effect on the adsorption of another substance, therefore, adsorption depends very little on ionisation of a substance. On the other hand the presence of a second substance may either decrease or increase the adsorption of the first compound, or one may increase at the expense of the other. Adsorption of mixtures, therefore, does not appear to follow any general rule and the effect of one constituent on another cannot be predicted. Adsorption by wood charcoal equals and at times exceeds that of animal charcoal. With a few exceptions the adsorption numbers of a series of compounds with different charcoals can be arranged in the same order, showing that adsorption depends to some extent on the chemical properties of substances. Charcoals vary in their adsorptive power, that from mulberry wood being superior to either Tate or acacia charcoal.
P. G. P. R.

GASTIGHT ROOFS PREVENT FIRE FROM LIGHTNING.—*Nat. Petr. News*, 1924, **16**. No. 5, 68.

The advisory committee on fire protection of the American Petroleum Institute have come to the conclusion that tanks provided with gastight all-steel tops, with vents properly protected against transmission of

flame, need no further protection against lightning. Oil fires caused by lightning are almost always the result of ignition of vapours escaping from a leaky tank roof flashing back into the tank. Few instances are on record of lightning directly striking a tank. F. G. P. R.

SOLIDIFICATION OF ORGANIC LIQUIDS.—A. B. Ray. U.S.P. 1,484,190. Feb. 19, 1924. Application, November 8, 1921.

Hydrocarbon liquids carrying gaseous substances are solidified by heating them under pressure and adding a small quantity of stearic acid. The stearic acid is saponified by the addition of a solution of alkali in a water-alcohol mixture and the mixture is then cooled. T. A. S.

RUSSIAN PETROLEUM AND OIL-SHALE INDUSTRY JOURNAL, 1923. Nos. 11, 12. —Programme for exploitation of petroleum in Baku region and general plan for the Petroleum industry in the Soviet Russia for next five years. By Smirnoff. Pp. 585–609.

In his review Mr. Smirnoff forecasts the following quantities of petroleum to be produced in the Baku districts, namely :—By the end of 1924, 290,300,000 poods ; in 1925, 370,700,000 poods ; in 1926, 457,600,000 poods ; in 1927, 458,000,000 poods ; in 1928, 495,000,000 poods. He divides the quality of the crude petroleum into four groups :—

1. Heavy fuel.
2. Light lubricating.
3. Paraffin ; kerosene.
4. Light kerosene.

In accordance to the quality of the various crude oils, Azneft* calculates the output :—

	Heavy Fuel Oil.	Lubricating Crude.	Kerosene Crude.	Total.
		(In million poods.)		
1924 ..	130 ..	78 ..	107 ..	315
1925 ..	160 ..	83 ..	143 ..	386
1926 ..	179 ..	88 ..	158 ..	425
1927 ..	202 ..	88 ..	168 ..	458
1928 ..	229 ..	88 ..	178 ..	495

Boring Operations.

It is expected in course of this year to have 285 boring rigs in operation and to bore 429,226 feet. Amongst the boring rigs 90 will be of the rotary type. The quality of the refined products to be received from the crude—the author calculates 15 per cent. in form of refined lubricating oil—5 per cent. of solar oil, and 30 per cent. lamp oil.

Grozny Petroleum Region.

The programme for that region is as follows :—For 1924, 96,000,000 ; 1925, 108,000,000 ; 1926, 120,000,000 ; 1927, 135,000,000 ; 1928, 160,000,000.

From the above crude it is calculated that about 31,000,000 poods of motor spirit can be produced if the cracking methods will be applied.

Other Petroleum Regions.

Ural-Emba, Cuban-Black Sea, Fergana :—It is expected that only the Ural-Emba region will be developed with the following prospective production :—1924, 9,000,000 ; 1925, 11,000,000 ; 1926, 15,000,000 ; 1927, 18,000,000 ; and 1928, 20,000,000 poods. P. D.

* The Soviet Department for Petroleum.

PROSPECTING FOR PETROLEUM IN AUSTRALIA.—E. C. Andrews. *Econ. Geol.* 1924, **19**, 157-168.

The gold discoveries of 1851 attracted prospectors of all nationalities to Australia. Their activities led to the discovery of mineral wealth throughout the continent, but not of oil. This was not the fault of the prospectors. A great many samples of scums and decomposing organic matter have been, and are still being, mistaken for seepages and sent for examination. Gas samples from numerous prospecting bores have almost always proved dry, Roma being an exception. So far as southern and eastern Australia are concerned, the conditions appear to be similar to those of the Indian Peninsula. The little that is known of the great north-western area suggests conditions similar to those of the eastern fields of the U.S.A. In New South Wales, out of hundreds of bores in Mesozoic and Palæozoic rocks, the Connamble Bore alone found a trace of oil. In the Tertiary of Victoria nothing has been found. Boring in Tasmania has been fruitless, but a minute seepage has been reported associated with Tasmanite and coal in the Mersey River basin. In Queensland the first Roma bore in 1900 encountered wet gas at 3683 feet. In 1908 another well at 3700 feet brought in more than a million cubic feet of gas a day at 200-300 lbs. pressure. At Orallo, near Roma, Dr. Jensen considers conditions more favourable. In South Australia no results have been obtained. In the northern part of Western Australia solid bitumens have been found in association with carboniferous rocks, and Government geologists have considered the conditions sufficiently favourable to justify test wells at various points. In Northern Territory prospecting has been unsuccessful. The Australasian region appears to have been built outward from the Archæan nucleus of Western Australia, and consists of (*a*) south-western nucleus; (*b*) outer Archæan zone; (*c*) inland plains of Eastern Australia; (*d*) plateaus of Eastern Australia. Archæan rocks are closely folded. Much folding went on locally during the Palæozoic, since when movements have been very gentle. The Mesozoic was a time of shallow and fresh water conditions. A marine fringe of Tertiaries occurs in the South. The Mesozoic and Cainozoic history of Australia differs widely from that of the oil-bearing zone of islands to the north. A parallel is drawn between Australia and the petroliferous Malayan arcs, and the continental regions of India and South Africa with the "Tethyan" petroliferous arc to their North, and the conclusion is drawn that, in spite of the oil indications described, there is little hope of finding petroleum in commercial quantities in Australia. W. G. W.

DISTILLATION AND REFINING.

RECOVERY OF GASOLINE FROM UNCONDENSED STILL VAPOURS.—D. B. Dow. *Nat. Petr. News*, 1924, **16**, No. 7, 53-7.

Uncondensed gas passing through the condensers from crude oil topping stills is termed "sweet gas," whilst that coming from tar stills or cracking stills is known as "sour gas." The former is all produced during distillation of the first 15 per cent. of the crude and when the naphtha fractions are re-run in the steam stills. Gas from these two sources can be led to a central absorption or compression plant where a small vacuum is held. On some plants the gas is merely passed into a water-cooled header, which is sufficient to condense a considerable proportion of the possible total. Very little permanent gas is contained in "sweet gas," 90 per cent. being condensible, which equals 30 gallons

per 100 cu. ft. of vapour. In practice an average of 7–8 gallons per 1000 cu. ft. is obtained. Pressure cracking stills and tar stills give "sour gas," which contains a very much larger proportion of permanent gas and consequently less condensible vapour, a barrel of gas oil on cracking distillation giving 160 cu. ft. of gas containing 2·8 gallons of condensible vapour per 1000 cu. ft., whilst a barrel of crude gave 52 cu. ft. of uncondensed vapour on topping. On plants employing both forms of stills the total volume of gas will be much larger, but a lowering percentage of condensible vapour than on a topping plant. The gathering lines are also more complicated and care has to be exercised in designing in order that the distribution of the vacuum shall be equable. "Sour gas" must be scrubbed to remove sulphur and its compounds. The production of gasoline by the gas plants always increases in hot weather, but falls off in winter owing to the more efficient cooling that occurs in cold weather, as well as to lessened evaporation from storage tanks when these are connected to the recovery plant. One unusual example was a production of 6000 gallons a day in summer, which fell to 500 gallons a day in winter. Three factors govern the gasoline content of uncondensed vapours—the nature of the still charge, the temperature of the stream leaving the condensers and the vacuum carried on the run-down lines. Crudes containing only small amounts of low boiling fractions give less uncondensed vapours in proportion than those with a high gasoline content. The temperature of the stream is very important, the amount of uncondensed vapours rising rapidly with increase of temperature, for example, the condensible gasoline from a barrel of Cushing crude at a stream temperature of 75° F. was 0·05 gallons, at 90° F. 0·15 gallons, at 109° F. 0·66 gallons and at 120° F. 1·01 gallons. Two square feet of condenser surface per gallon distilled per hour is the usual allowance, but the efficiency of this depends on the temperature of the cooling water. On redistilling gasolines distilled from crudes at different stream temperatures the gasoline content of the uncondensed vapours from the redistillation decreased with rise in temperature of the stream in the crude distillation. Thus with a crude distillation stream temperature of 75° F. the redistillation gave uncondensed vapours containing 0·13 gallons of gasoline per barrel of distillate, whilst with a crude stream temperature of 98° F. 0·04 gallons of gasoline were in the vapours on redistillation, the redistillation stream being in both cases at the same temperature as the crude stream. For each 2° rise in stream temperature between 50° F. and 90° F. the number of cubic feet of uncondensed vapour varies 3 per cent. as a general rule, but above 90° F. the rise is more rapid. From this the following formula will give the recoverable gasoline, in gallons per barrel distilled, at any stream temperature between 50 and 90° F.

$$\frac{A}{1000} \times \left(F \pm \frac{T}{2} \times 0{\cdot}03\right)$$ where A = gallons of gasoline per 1000 cu. ft., F = the number of cu. ft. per gallon distilled at 70° F. stream, and T the difference of the stream temperature from 70° F. In pressure cracking stills the volume of uncondensed gas is greater at higher pressures, but contains a smaller proportion of condensible gasoline, though this depends somewhat on the temperature maintained and the character of the oil distilled. For example, Mexican light crude—200 cu. ft. of gas, per barrel charged, containing 4 gallons of gasoline per 1000 cu. ft. of gas; Mid-Continent crude—80 cu. ft. of gas,

7 gallons per 1000 cu. ft.; gas oil—140 cu. ft. of gas, 3 gallons per 1000 cu. ft. Tables are given showing details of two eleven months tests run at refineries in which the total amount of crude distilled was 1,390,000 and 4,800,000 barrels. In the first case the average amount of gasoline obtained by means of compression and absorption from the uncondensed vapour was 0·65 gallons per barrel of crude distilled, which equals 1·57 per cent. of the crude charged. The gases contained approximately 8 gallons of recoverable gasoline per 1000 cu. ft. In the second case the gases contained an average of 8·83 gallons of gasoline per 1,000 cu. ft., and the amount recovered per barrel of crude distilled averaged 0·576 gallons. F. G. P. R.

THE RÔLE OF ADSORPTION IN PETROLEUM REFINING.—H. L. Kauffman. *Chem. and Met. Eng.*, 1924, **30**, 153–156.

The value of fuller's earth as a decolorising agent cannot be determined by analysis, but only by a practical test. Acid-treated clays are generally used in "contact filtration," in which the oil is mixed with finely divided clay, heated and agitated, the clay being subsequently removed by filter presses. The Californian clays Halloysite, Pyrophillite and Montmorillonite, though having little decolorising or de-acidifying value in the raw state, have a high adsorptive value after acid treatment. Silica-gel, with a highly porous structure, is adapted to the refining of gasolines and kerosenes, as it removes sulphur compounds by selective adsorption. Adsorbents decolourise oil by separating solid suspended, colloidal and dissolved impurities. They separate, to some extent, paraffin hydrocarbons, lowering the cold test, and remove compounds that cause emulsification. The smallest particles of floridin earth contain microscopic canals, which greatly increase the adsorptive surface. Finely crystalline calcium carbonate and barium sulphate, not possessing this porous structure, have little absorptive power. In the action of fuller's earth some chemical disintegration occurs owing to selective adsorption. The earths are generally "tempered" by drying at 500° to 900° F. (260° to 492°). The proper degree of heating is judged by the colour of the earth. Some earths, however, lose much of their bleaching effect on drying. In refining gasoline and kerosene the material is usually applied to the oil in an agitator and the mixture then blown with air, and the clay removed by settling or by filter press. Filtration through a column of fuller's earth is sometimes used for refining kerosenes, long-time burning oils and mineral seal oils. Filtration through a column of coarsely-ground material is desirable when several fractions of different degrees of refining are required, while the contact system is preferable when the whole product is desired in one quality. The finely divided acid-treated clays used in the contact system are several times as efficient as fuller's earth of the same mesh. The adsorbed impurities may be extracted by suitable solvents. The time adsorption curve for fine clay is of a logarithmic nature. The adsorption by percolation through coarse fuller's earth may be represented by the formula $\frac{x}{m} = K.Cp$, in which x is the quantity adsorbed, m quantity of adsorbent, C concentration of solution acted upon, and K and p constants depending on the nature of the adsorbent, the substances adsorbed and the solvent. Most lubricating oils are given a chemical treatment followed by clay treatment. In practice the sour oil is pumped to open top agitating tanks in the filter

house and agitated by mechanical stirrers, the necessary amount of clay added, and the temperature raised to 250° to 350° F. (121° to 177°) for 10 to 15 min. The evolution of steam from the clay assists in agitating the oil and prevents oxidation. The oil is then filtered hot, in filters 6 to 10 ft. in diam. and 14 to 30 ft. deep. Anti-gravity filtration, in which the oil is pumped up through the clay, gives 20 per cent. greater efficiency from the clay. The earth is revivified by heating in kilns to 1000° to 1400° F. (538° to 760°). A table of results of filtration of steam-refined lubricating stock shows that separation into fractions of various gravities, viscosities, etc., takes place. Some methods have been proposed for treating oil vapours by adsorbing agents. H. M.

Conclusions on Effect of Vacuum on Oil and Gas Separators.—J. H. Wiggins. *Nat. Petr. News*, 1924, **16**, No. 5, 61–2.

In the oil field practice the crude oil is sometimes passed through a vertical pipe on which a vacuum, ranging from a few to 25 inches of mercury, is held in order to remove the wild gas. Tests were carried out to ascertain the amounts of gasoline actually removed in this way. A measuring tank was connected to an elevated constant level vacuum tank, which in turn was connected to a stock tank. A vacuum of 22 inches was kept on an average and the temperature of the oil in the measuring tank was 95° F. Oil was kept flowing for 4½ hours from the measuring tank into the stock tank by way of the vacuum tank, in which it remained actually about 5 minutes. The amount lost by evaporation due to the vacuum was 1 per cent. of the total throughput, but this was recovered at the gasoline absorption plant. The losses by plain evaporation in the measuring and stock tanks were 2·24 per cent., a fact which emphasises the necessity for making stock and flow tanks gas tight. The temperature of the oil and the time it remains in the vacuum tank will naturally affect the amount of evaporation due to vacuum, and if the latter is small and the temperture low the losses will be reduced to a very small quantity. It is a moot point whether it would pay to work a high enough vacuum to draw off sufficient gasoline to appreciably reduce the pipe-line and storage losses, especially as the combination of pressures, temperatures, time of exposure and character of the oil are almost unlimited. F. G. P. R.

Recovery of Benzene by the Wash Oil and Active Charcoal Processes.—Steding, *Gas. u. Wasserfach*, 1923, **66**, 457–9.

The author states that complete recovery of benzol is possible by means of activated charcoal, one cubic meter of which will absorb 50–70 kgs. of benzol from gas containing 25–35 gms. per cu. m., or in other words will debenzolise 1400–2000 cu. m. of coal gas. An activated charcoal plant costs 20–25 per cent. less than a wash oil plant, the operating costs of the two being 6·7 per cent. and 21 per cent. respectively of the value of the benzol extracted. F. G. P. R.

Silica Gel as an Industrial Adsorbent. E. C. Williams. *J. Soc. Chem. Ind.*, 1924.

Considerable attention has lately been drawn to the use of silica gel as an adsorbent for condensable vapours and as a refining agent for liquids, particularly petroleum oils. The present paper deals mainly with its employment for the recovery of benzene hydrocarbons from coal or coke-oven gases for use as a motor spirit. When this work was commenced two years ago the author was unaware that Patrick and others were

undertaking the same work, and therefore the results and conclusions arrived at are independent of the American investigators. Certain inorganic hydroxides, such as those of copper, iron, aluminium and silica when precipitated from solution form flocculent, gelatinous precipitates which, on drying, form a hard porous mass capable of adsorbing water and other vapours. Graham first made in 1861 a colloidal solution of silicic acid by the action of HCl on sodium silicate and removal of the dissolved electrolytes by dialysis. This solution dried over sulphuric acid to a hard glassy mass of silica gel. Between 1890 and 1900 van Bemmelen examined the vapour pressure phenomena displayed by silica gel, and showed that, on drying, the hydrogel contracted to a glassy porous mass capable of adsorbing water and other vapours. He particularly investigated the effect of the concentration of the solutions from which the gel was prepared and the rate of drying upon its porosity and adsorptive power. Zsigmondy, Patrick and others have also investigated the structure of silica gel. The fact that a jelly containing as many as 100 molecules of water to each molecule of SiO_2 is a moderately stiff elastic structure indicates some strong bond between the silica and water, but as the latter can be completely removed or replaced by other liquids without effecting the characteristic structure of the gel this structure cannot be of a honeycomb or cell-like form. It may consist of threads of silica intertwining like those of cotton wool, or be simply a formless collection of particles held together by the adsorption of water at their surfaces. Either view would account for the open structure which the gel possesses, but the ultramicroscope is unable to reveal the true form. On gradually removing water the gel rapidly contracts until the water content has fallen from 122 to 2 molecules per molecule of SiO_2, the decrease in volume of the gel exactly corresponding to the volume of water removed. The particles of SiO_2 have, therefore, gradually closed together while the spaces between them have remained completely filled with water. At this point no further contraction occurs, and complete dehydration leaves a clear lustrous substance like broken glass, in which the water is replaced by air. In this form the gel is employed as an adsorbent, since it is highly porous yet optically homogenous. Being beyond the power of the ultramicroscope the diameter of the pores must be of the order of some $10\mu\mu$. Supposing a cube of 1 cm. edge, the surface therefore being 6 sq. cms., were divided into cubes of $10\ \mu\mu$ edge, the total surface would be 600 sq. metres. The extraordinary difficulty of removing the last traces of moisture from the surface of glass is well known and is dependent on the attraction between the molecules of solid and vapour, these forces being generally assumed to be of a chemical or polar origin and leading to a definite orientation of the adsorbed molecules at the surface of the solid. Adsorption of this type would be affected by the molecular arrangement of the vapour and of the adsorbent molecules, and will be selective as in the case of certain forms of activated charcoal. Adsorption may also be due to capillarity, and as it is known that the vapour pressure of the liquid over the meniscus in a tube is less than in an open vessel it is evident that if a sufficiently fine capillary tube is brought into an atmosphere of condensable vapour in which the vapour pressure of the vapour is higher than that which would be in equilibrium with the liquid in the capillary, then a partial condensation of the vapour in the capillary will take place. Silica gel may be regarded as a mass of fine capillaries, probably wedge shaped and of different sizes, which in the presence of a condensable vapour become filled with liquid from the

apex of the wedge outwards until a point is reached where the diameter of the capillary is such that the vapour pressure at the liquid meniscus is equal to that of the vapour in the surrounding atmosphere. The amount of vapour adsorbed is, therefore, a function of the vapour pressure, and necessarily also of the temperature. Change of either alters the ease of condensation, which Patrick expresses in terms of a single condition of the vapour instead of in terms of the two. This single condition which determines the degree of adsorption is the ratio of the actual vapour pressure of a vapour to its saturated vapour pressure and is called by Patrick the "corresponding pressure." If this is equal to unity the amount of vapour adsorbed is a finite maximum and is independent of temperature. In proof of this Patrick has shown that silica gel absorbs the same amount of SO_2 whatever the temperature, provided only that the "corresponding pressure" is equal to unity. The amount of vapour adsorbed by a given mass of gel is so great that it must be regarded as condensed in the liquid state. If exposed to the saturated vapour of water, benzene, or chloroform the same liquid volume of each is adsorbed and is equal to that taken up if the gel is immersed in the liquid, and is, therefore, a complete filling of the pore spaces. Many workers regard adsorption of vapours by gel as a purely physical capillary phenomenon. There are, however, observations which do not agree with this view, but for general purposes the capillary theory suffices. For the recovery of condensable hydrocarbons from coal gas activated charcoal and ferric hydroxide gel had the disadvantages of being easily destroyed during revivification when burning off the contaminating resinous matter adsorbed from the gas. Silica gel has the advantage of being chemically inert to H_2S and such like compounds, and also being unaffected by roasting at 600° C., which counteracts the greater adsorptive power of activated charcoal for vapours at low concentrations. The results obtained with silica gel by the author completely agree with those obtained independently by E. B. Miller with mixtures of air and benzene. The gel was prepared by Patrick's method (*J. Am. Chem. Soc.*, 1920, 951), and with a saturated air-benzene mixture containing 9·5 per cent. of benzene the gel adsorbed quantitatively up to 40 per cent. of its weight of benzene. After this the efficiency fell off rapidly until adsorption was complete with 55·4 per cent. benzene content. With air containing 0·8 per cent. by volume of benzene—about the usual figure in coal-gas—saturation of the gel at 16° C. was complete with 13·7 per cent by weight, whilst 11 per cent. was adsorbed at 100 per cent. efficiency. The saturation curve for different concentrations of benzene is of the usual form of adsorption isotherm. In the case of coal gas there are substances present which may foul the gel as well as a number of different vapours each with its own partial pressure (p) and "corresponding pressure" p/p_s—where (p_s) represents the saturation pressure.

Pre-benzole	(p) 0·165 m.m.Hg.	..	(p_s) 195	..	p/p_s 0·0009
Benzene ..	5·880	..	60	..	0·0980
Toluene ..	1·158	..	14	..	0·0825
Xylene ..	0·528	..	4	..	0·122
Naphthalene	0·019	..	0·03	..	0·65
Water ..	12·780	..	12·78	..	1·00

If gases containing each constituent singly at the above partial pressures were passed through gel the amounts adsorbed would be in the ratio of the corresponding pressures, but with all present in one gas it was impossible to predict what would happen. Would one constituent

displace another which had already reached saturation point in the gel, or would it merely continue to fill up what space was left ? To prove this water and benzene were mixed with air in the proportion in which they exist in coal gas, *i.e.*, 1 to 2·35 when considered as liquid condensates, which, however, equals 2·13 to 1 in volume of vapour. Theoretically benzene, being in the greater liquid proportion should be able to enter the gel freely in the first stages of adsorption before sufficient water has arrived to exclude it. Actually also this was found to be the case, benzene being quickly adsorbed up to 7·92 per cent. of the weight of the gel, after which water gradually displaced the whole of the benzene and continued being readily adsorbed. The presence of water vapour is, therefore, a serious factor in coal gas since it not only prevents the benzene attaining the normal saturation value corresponding to its vapour pressure, but eventually leads to complete washing out of that initially adsorbed, even though the concentration of benzene in the gas remains constant. This is probably due to the relative ease of wetting silica by water and benzene. If silica is preferentially wetted by water and benzene is adsorbed less strongly at a water face than at a silica one, then as the water film develops over the silica the benzene must be driven out. Coal gas was now tried, being passed through six adsorption tubes until benzene just commenced to pass from the last tube. Each tube was then separately distilled in vacuo and the products analysed, and the results showed that water and the higher boiling hydrocarbons were concentrated in the first two tubes, whilst almost pure benzene was found in the remainder. In the next experiment varying volumes of gas were passed through a fixed weight of gel to discover the greatest amount of gas that can be passed to give a maximum recovery of hydrocarbons valuable as motor spirit. This occurs when benzene reaches its break point, at which saturation with regard to the gel is attained for benzene. Up to this point all hydrocarbons from benzene upwards are quantitatively adsorbed and the recovered mixture therefore contains these in the same proportion as they exist in the gas, which expressed as per cent. weight of the gel is benzene 7·65, toluene 1·80 and xylene 0·39. The total effective adsorption is, therefore, about 10 per cent. of the weight of the gel. The experiments more than covered the limits of commercial operation, but no evidence was obtained of any washing out of benzene by water vapour. The lower boiling constituents of coal gas, such as CS_2, are present at such small partial and corresponding pressures that the amounts adsorbed are practically negligible. This is of importance in refining for motor spirit. The benzole recovered showed no signs of discoloration or resinification on storage, but contained 0·4–0·5 per cent. of sulphur. The main points of superiority over oil adsorption are: (1) 11·5 per cent. by volume adsorption against 3–4 per cent. by oil; (2) complete recovery of useful hydrocarbons, rarely obtained with oil; (3) freedom from pre-benzole and creosote ; (4) the possibility of eliminating chemical treatment and thus saving 5–10 per cent. loss ; (5) avoidance of acid sludge nuisance and (6) complete removal of naphthalene, a great boon to gas manufacturers. The author was invited to be present at trials in America on coke oven gas and a description is given of the large scale plant erected for that purpose. Briefly the gas and gel are made to pass in counter current to one another in a closed system, the gas emerging stripped at one end and the gel coming out saturated at the other. The gel is then heated to 300–350° C. to drive off the contained hydrocarbons and finally roasted in a second furnace at 550–600° C. in a current of air to burn off non-volatile products of adsorption. It is

then ready to re-enter the cycle in a fully activated condition. The plant was capable of handling 80–100 cu. ft. of gas per minute, and an average efficiency of 95·6 per cent. recovery of crude benzole was obtained on continuous working. The recovered product was not, however, so satisfactory as that obtained on the laboratory scale, being yellow and requiring refining. Filtration through gel and redistillation gave 88–89 per cent. of colourless distillate boiling below 130° C., the action of the gel being to polymerize gum forming constituents to high boiling compounds, which remain behind in the still. The sulphur content, however, was only reduced from 0·37 per cent. to 0·28 per cent. The filtering operation is carried out in agitators, from which the mixture passes to Oliver continuous vacuum filters. The gel then goes to primary and secondary activators as described above. Losses of liquid amount to 2 per cent. as a maximum. The quality of the treated motor spirit was excellent, but owing to the fact that gel does not remove all unsaturated compounds, but only those liable to polymerize and form gum the sulphuric acid test cannot be complied with. It is, however, superior to acid washed benzole, which is able to pass the test, in that the latter contains some neutral sulphuric acid esters, which are not removed by alkali or water. These decompose at high temperatures and are liable to damage metal parts of engines. It is evident that silica gel can be applied to many other industrial problems, but the author has preferably confined himself to the discussion of one only. F. G. P. R.

Method of Treating Natural-gas Gasoline and of Making Gas Therefrom.—A. N. Kerr. U.S.P. 1,482,933 of February 5, 1924. (Appl. April 9, 1921.)

The lighter constitutents are distilled from natural gas gasoline and, without intermediate condensation, are mixed with air to form a transportable gas. T. A. S.

Improvements in or relating to Retorts or Stills.—F. Lamplough and N. C. Harper. E.P. 211,219 of November 14, 1922.

The improved still consists of a pipe partially filled with graphite and surrounded by a jacket, which is in turn surrounded by a coiled tube. Water is admitted to the tube, where it is flashed into steam and superheated. The superheated steam passes through the jacket and enters the bottom of the still, where it comes in contact with the oil to be distilled. The vapours from the still pass into a column from which heavy condensate is returned to the bottom of the still. It is claimed that no local overheating takes place and that the still is easily controlled T. A. S.

Cleaning Solvent.—V. S. Allien, Assr. to Darco Corpn. U.S.P. 1,484,167 of February 19, 1924. (Appl. January 19, 1922.)

Dry cleaners' gasoline is recovered by settling to remove the coarse impurities, adding activated carbon and calcium carbonate and centrifuging the mixture. T. A. S.

Motor Fuels.

The Vapour Pressures of Gasolines and Light Petroleum Naphthas.—F. H. Rhodes and E. B. McConnell. *Journ. Ind. and Eng. Chem.*, **15**, 12, p. 1273.

A number of methods for the determination of vapour pressure of gasoline have been devised, and although the results are informative as to the safety of containers, etc., they are subject to certain errors and do

not indicate the true vapour pressure of the hydrocarbon at a given temperature. The paper describes a method which endeavours to eliminate these errors and also to determine any relationship between vapour pressure and other characteristics of the fuel, *e.g.*, Gravity and Volatility. The apparatus consists of a glass bulb of 40 c.c. capacity mounted in a water bath and connected through a spiral of capillary tubing to a mercury filled manometer and mercury reservoir. The bulb is attached to a mechanical shaker, so that the contents can be violently agitated. A fixed zero point is marked on the tube just below the bottom of the bulb and also a corresponding zero point on the manometer when the whole is at atmospheric pressure. Corrections are applied to the manometer reading to compensate for the differences in temperature between the mercury in the manometer and the mercury in the spiral capillary within the thermostat. All the air is forced out of bulb by means of a stop cock fixed at the top, then about 15 c.c. of the sample is drawn in. The cock is now closed and levelling reservoir lowered until the spirit boils vigorously under the reduced pressure after which the pressure is raised to slightly above atmospheric, thus causing the vapour to re-condense and re-dissolve. Any air, however, that may have been in solution remains unabsorbed and is removed, the process being repeated until no more air is set free.

The water bath is now heated to the required temperature of the experiment and maintained constant throughout. The levelling bulb is lowered until the mercury stands at the zero mark and the spirit shaken vigorously to establish equilibrium between liquid and vapour and also temperature, the levelling bulb being adjusted from time to time to maintain the level at the zero point. The agitation is continued a few minutes after the level has become constant and then the manometer reading taken. From this, the barometer reading and the rise in pressure on the manometer, the vapour pressure is calculated, the above corrections including that due to the weight of gasoline above the mercury being applied.

The accuracy of the method was tested, using pure water at various temperatures, the results obtained agreeing with those of Regnault within 1 mm.

The error, common to other methods, due to dissolved air was found to be considerable.

All the typical American Spirits were examined and with the exception of a few abnormalities these showed a definite relationship between Vapour Pressure, Specific Gravity and Volatility.

Results are tabulated and shown graphically together with a sketch of the apparatus employed. S. B.

NATURAL GASOLINE PRODUCTION IN 1922.—*Nat. Petr. News*, 1924, **16**, No. 5, 68.

The United States Geological Survey publish statistics showing the amount of gas treated in the different states, with yields by compression and absorption, and the number of plants working the two systems. Five hundred and forty-five billion cubic feet of gas was treated by 402 plants, which produced approximately 506 million gallons of gasoline, an average of 0·9 gallons per 1000 cu. ft. Absorption methods had increased 74 per cent., compression methods decreased 10 per cent. and combination plants increased 29 per cent. over those of 1921. The natural gasoline produced was equal to about 8 per cent. of that got from petroleum. F. G. P. R.

Cracking.

THE PREPARATION OF SYNTHETIC OIL MIXTURES (SYNTHOL) FROM CARBON-MON-OXIDE AND HYDROGEN.—F. Fischer and H. Tropsch. *Brennstoff Chem.*, 1923, **4**, pp. 276–285.

Water gas, freed as completely as possible from sulphur compounds, was treated at 400–450° C. and 150 atmospheres pressure, in the presence of Fe and K_2CO_3. Oil and water layers were formed, in which the following products were identified. Acids formed 10 per cent. of the mixture, ranging from formic acid to those derived from C_9H_{18}. Forty per cent. water soluble and partially soluble alcohols, aldehydes and ketones were found. Forty-eight per cent. of the oil was volatile with steam and contained aldehydes, ketones and hydrocarbons to C_9. Two per cent. of the oil was non-volatile in steam. The fraction of the oil boiling between 80–200° C. is suitable for motor fuel. The oil (synthol) when heated with water under pressure at 450° C. for one hour yielded a mixture of saturated hydrocarbons, of which naphthalene was one, boiling from 50–300° C. T. A. S.

PROCESS FOR TREATING HYDROCARBONS.—S. L. Gastlan. U.S.P. 1,484,612 of Feb. 19, 1924. (Appl. Jan. 8, 1923.)

Hydrocarbons are cracked by vaporising them at a low temperature under reduced pressure. The vapours are removed and suddenly compressed and the pressure is suddenly released. T. A. S.

PROCESS OF CONVERTING OILS.—A. McD. McAfee. U.S.P. 1,482,438 of Feb. 5, 1924. (Appl. March 29, 1922.)

High boiling oils are heated with anhydrous aluminium chloride to gradually increasing temperature and the low boiling hydrocarbons formed are condensed. When distillation of the aluminium chloride takes place this is collected separately and returned to the cleaned heating chamber with fresh oil. T. A. S.

METHOD OF TREATING HYDROCARBONS.—C. P. Dubbs, Assr. to Universal Oil Products Co. U.S.P. 1,484,445 of Feb. 19, 1924. (Appl. Feb. 28, 1921.)

Gasoline-like products are produced from heavy hydrocarbons by heating with latter to cracking temperature in a still. The vapours are permitted to expand and passed through a reflux condenser, whereby heavy constituents are returned to the still. The temperature of the reflux condenser is thermostatically controlled. The contents of the still are maintained under pressure. T. A. S.

Lubricating Oils and Waxes.

THE LUBRICANT AND ASPHALTIC HYDROCARBONS IN PETROLEUM.—C. F. Maybery. *Ind. and Eng. Chem.*, **15**, 12, p. 1233–1238.

Although considerable knowledge has been gained as to the nature and composition of the lighter constituents of petroleum the investigation of the higher members has always presented a much more difficult problem, due partly to the complexity of those members, but more particularly to the fact that the ordinary methods of fractionation cannot be employed. Even under high vacuum some of the constituents cannot be distilled without decomposition. Having regard to the fact that the known members of a series showed variations in other physical

constants the author has employed fractional solubility as a means of separation, using a mixture of equal parts of ether and alcohol as the solvent. The general method of procedure was to distil the crude oil —up to 300° C. under a pressure of 30 mm. The solid residue so obtained was then dissolved in ether to a dilute solution and alcohol added until the paraffin began to precipitate and the solution cooled to 0° C., filtered cold, and further cooled to −20° C. and again filtered. In this way a paraffin free residue was obtained on evaporation of the solvent. This residue was now shaken with the solvent heated to boiling point, the soluble portion decanted off and the solvent removed by distillation. Treating the insoluble portion from each extraction in a similar manner fifteen fractions were obtained, representing homologues of diminishing solubility. For further purification the least soluble fraction was heated with the solvent, until partial solution was obtained and the solution poured off and used as solvent of the next fraction and so on to the most soluble and lightest fraction, this procedure being repeated six times. Typical American and Russian oils were treated in this way and the efficiency of the method appeared in the differences in consistency between the heavy fractions, viscous semi solid lubricants of the Appalachian oils, or black tarry asphalts of the Texas and Russian Oils, and the light amber colour fractions. In order to separate these homologues into their respective series, each fraction was about half dissolved in the hot solvent, the solution decanted off, and the solvent removed from the soluble and insoluble parts, thus separating each fraction into two parts, which were called D and H hydrocarbons. In the heavier fractions the D hydrocarbons were lubricants and the H hydrocarbons asphaltic. The constants relied upon for the final grouping and identification were specific gravity, molecular weight, Hydrogen –Carbon content. Molecular weight determinations presented some difficulties, Stearic Acid at 50° C. proving to be the most suitable solvent. Hydrocarbons ranging from series C_nH_{2n-6} to C_nH_{2n-26} and with molecular weights varying from 180 to 1784, were isolated. In addition to these hydrocarbons, compounds containing oxygen were also isolated and thought to be carboxyl acids or esters. These were present in both American and Russian crudes up to 2 per cent., and showed a high specific gravity and viscosity. Of the two forms of unsaturation the lubricant hydrocarbons show the ring form only, as shown by iodine values, and they do not appear to give the formalite reaction as applied by the Marcusson method. Tables showing the composition and physical constants of each of the constituents present in all the oils examined, are given. S. B.

ON THE STRUCTURE OF PARAFFIN WAX IN GROZNY RESIDUUM.—Tycinin. *Russian Pet. and Oil Shale Ind. J.*, pp. 620–633.

The author has investigated the question of removing paraffin wax from the Grozny liquid fuel, which fuel is difficult to use owing to its low solidifying temperature. Preliminary experiments have shown that the paraffin wax in Grozny petroleums and residue possesses a crystalline structure, which changes abruptly in connection with the heat treatment. A thermo-microscopic method was elaborated, consisting in the investigation of the crystalline structure of petroleum products under the microscope in polarised light during the different phases of heat treatment. The dimensions of the crystals were measured by means of an eyepiece micrometer, or on microphotographs.

The determination of the maximum solidification temperature and structure of paraffin in residuum.—The solidification point of paraffin

petroleum products, refined or not refined, varies as the result of different conditions, including the heating. Russian chemists have established the fact that paraffin petroleums and mazouts show for each given temperature a certain maximum solidification; for different products the maximum is reached at different heating temperatures between 40° and 70°. A further rise of heating temperature lowers the solidification point. After leaving alone such a superheated product for some time, it acquires spontaneously the higher solidification temperature, returns to the normal state. These phenomena can be explained as follows. By increasing the heating, the higher melting paraffins contained in the original material in the form of large conglomerates melt and pass into solution; this increases the quantity of substance which can be deposited on subsequent cooling as small needles and thus raise the temperature, at which the petroleum loses its mobility. At a certain temperature all the high melting paraffines melt and pass into solution, forming a homogeneous fluid (maximum). Further, owing to causes at present unknown, optimum conditions for the formation of large crystals are created, in consequence of which the crystallising substance is distributed into more compact crystals less closely interconnected, and the product ceased to be liquid at a lower temperature. The author considers the paraffinous products to be true solutions of crystalline paraffin in the liquid substances of petroleum. The distribution of the surplus paraffin as crystals of greater or smaller dimensions determines the solidification temperature.

P. D.

Coal, Shale, Pitch and Asphalt.

Improvements in or Relating to the Treatment of Tar and the like Liquid Hydrocarbons.—A. W. H. Vivian. E.P. 210,909 of Nov. 24, 1922.

Tar or similar liquid hydrocarbon is heated to about 87° C. and treated with 5–8 per cent. sulphuric acid and 2–3 per cent. nitric acid is then added. When the action of the acids is completed, heating is discontinued and paraffin oil added to reduce the viscosity of the mixture. After standing for 10 minutes the mixture is cooled as rapidly as possible. The light oils rise to the surface and the heavier binding materials sink to the bottom of the pan. The light oils are removed and distilled. The binding material is washed with water, the washing being carried out at a high temperature if hard binding material is required. The residual acid may be neutralised with small quantities of 5–8 per cent. alkali. The binding material is then run off into moulds. T. A. S.

Shale Retort.—C. J. Dunten. U.S.P. 1,482,677 of Feb. 5, 1924. (Appl. Oct. 4, 1922.)

A vertical retort, having a vapour off take, is fitted with a device for introducing successive charges of shale at the upper end of the retort without allowing the admission of air. The device consists of a receiving passage way between the hopper and the retort fitted with a plurality of horizontal gate valves, which are opened at different times. An exactly similar device is fitted at the bottom of the retort for the removal of spent shale. T. A. S.

CURRENT BIBLIOGRAPHY.

Compiled by W. J. WILSON, F.I.C., A.C.G.I.

1. Geological.

Gulf Coast Saline Domes.—R. B. Thacker. *Petr. Age* **13**, (7), 20.

Research on Texas Arm of Gulf Embayment.—H. M. Robinson. *Oil. Weekly* **32**, (10), 61.

The Teapot Dome Naval Reserve No. 3, Wyoming.—F. G. Clapp. *Oil Tr. J.* **15**, (3), 31.

Height of Petroliferous Salt Domes Increasing.—Thacker. *Petr. Age Petr. Times* **11**, 530.

Four Horizons Below Mississippi Lime.—L. H. White. *Oil and Gas J.* **23**, (15), 42.

Laccolithic Domes in Rocky Mountains Thought Oil Bearing.—F. B. Taylor. *Oil and Gas J.* **23**, (15), 115.

North Casper Anticline Ready for Test.—*Oil Weekly* **32**, (13), 25.

Hope to Find Oil Along Choctaw Fault.—H. D. Easton. *Oil and Gas J.* **23**, (17), 62.

Relation of the Balcones Fault and Oil.—S. C. Lowe. *Oil and Gas J.* **23**, (17), 64.

Structure of Los Angeles Basin and Environs.—I. East Side.—J. E. Eaton. *Oil Age* **20**, (6), 8. *Chem. Abstr.* **18**, 804.

Geology of Fraser River Delta Map-Area.—W. A. Johnston. *Can. Dept. Mines Memoir* 135. *Chem. Abstr.* **18**, 958.

Petroleum Deposits in Montenegro.—G. Petunnikoff. *Petroleum* **10**, 1275. *Chem. Abstr.* **18**, 958.

Petroleum Geology Past and Present.—R. Arnold. *Bull. Amer. Assoc. of Petr. Tech. Oil Engineering and Finance* **5**, 267.

On the Relative Value of Species of Smaller Foraminifera for the Recognition of Stratigraphic Zones.—T. W. Vaughan. *Oil Engineering and Finance.* **5**, 143, 288.

A Tragedy in Geology.—H. Basedow. *Petr. Times* **11**, 692.

Some Structural Features of the Plains Area of Alberta caused by Pleistocene Glaciation.—O. B. Hopkins. *Bull. Geol. Soc. Am.* **34**, 419.

Merging of Carlile Shale and Timpas Limestone Formations in Southeastern Colorado.—H. B. Patton. *Bull. Geol. Soc. Am.* **34**, 495.

Revue de Géologie.—J. Revil. *Rev. Gén. Sci.* **34**, 306.

2. Geographical.

Recent Oil Developments in Spain.—T. C. Bannon. *Am. Inst. Min and Met. Engineers. Petr. Times* **11**, 475.

Prospective View of France's Petroleum Imports.—*Petr. Times* **11**, 476.

The Oil Industry in Poland.—S. Bartoszewicz. *Petr. Times* **11**, 479, 590.

World Production of Oil Shows General Increase.—*Chem. and Met. Eng.* **30**, 473.

South Texas Fields in Line for Big Play.—S. W. Robinson. *Oil Weekly* **32**, (10), 21.

The Fort Norman Oil Area of Canada.—G. S. Hume. *Oil News* **15**, 364, 394.

California Completed 980 New Wells in 1923.—C. O. Sprenger. *Oil Tr. J.* **15**, (3), 60.

Roumanian Oil Industry has Poor Year in 1923.—*Oil Tr. J.* **15**, (3), 70.

Coastal Crude Should be Reserved for "Lub" Content.—S. C. Lowe. *Oil Tr. J.* **15**, (3), 72.

Trinidad: Then and Now.—H. Pearson. *Oil News* **15**, 393, 451.

Venezuela.—G. Howell. *Oil Engineering and Finance* **5**, 207.

Empire Oil: The Progress of Sarawak.—T. G. Cochrane. *Oil Engineering and Finance* **5**, 210.

Petroleum Refineries in U.S.A.—*Financial Review. Oil Engineering and Finance* **5**, 237.

World's Production of Oil in 1923 Exceeds Billion Barrels.—*Nat. Petr. News* **16**, (1), 24.

Second Wilcox Sand Well at Stroud makes new Field Probable.—A. F. Hinton. *Nat. Petr. News* **16**, (1), 53.

Survey Reviews Crude Petroleum Situation of 1923.—*Nat. Petr. News* **16**, (6), 22.

Texas Salt Domes Yield 45% of State's Oil Recovery.—P. Wagner. *Nat. Petr. News* **16**, (7), 49.

Mexico's Oil Exports Fall of 45 Million Barrels in 1923.—*Nat. Petr. News* **16**, (7), 50.

More Wells, Less new Production than in 1922, North Texas Record —*Nat. Petr. News* **16**, (2), 57.

Petroleum Industry and Trade of Peru and Equador.—W. W. Dobkin. *Trade Information Bull.* 178.

Canada's Future Petroleum Production.—E. Coste. *Nat. Gas.* (*Jan.*) *Petr. Times* **11**, 533.

California's Petroleum Shipments in 1923. C. J. von Bibra. *Oil and Gas J.* **23**, (15), 21.

LOUISIANA GAS FIELDS REVIEWED, 1923 DEVELOPMENT AND PROSPECTS.—M. E. Wilson. *Oil and Gas J.* **23**, (15), 82.

MEXICAN POOLS FACING RAPID DEPLETION.—A. R. McToe *Oil Weekly* **32**, (11), 21.

ROUMANIAN CRUDE PRODUCTION SHOWS 10 per cent. INCREASE DURING PAST YEAR.—*Moniteur du Pétrole Roumain Oil Weekly* **32**, (12), 79.

BURMA FIELDS SHOW INCREASE DURING 1923; MUCH DRILLING. *Oil Weekly* **32**, (12), 81.

MEXICAN REPORT ON OIL.—*Oil and Gas J.* **23**, (17), 66.

BITUMINOUS SANDS OF ALBERTA.—*Oil News* **15**, 440.

WIETZE FIELD, HANOVER, GERMANY.—*Oil News* **15**, 442.

TAR SANDS OIL PROCESS.—Calgary Herald. *Oil News* **15**, 454.

CALIFORNIA OIL IN 1923.—R. D. Bush. *Oil News* **15**, 460.

SOME ASPECTS OF THE SOUTH AMERICAN OIL INDUSTRY.—*Petr. Times* **11**. 586.

STUDY OF A CRUDE OIL FROM TSELFAT (MOROCCO).—L. Boisselet and G. Piersch. *Mat. Grasses* **16**, 6659. *Chem. Abstr.* **18**, 1047.

CRUDE OIL OF GBELY.—Fuel Technology Inst. at Prague. *Petr. World* **21**, 186.

CEYLON IMPORTS OF PETROLEUM.—*U.S. Commerce Rept. Petr. World* **21**, 191.

POSITION OF THE GERMAN PETROLEUM TRADE.—*U.S. Commerce Rept. Petr. World* **21**, 192.

OIL TRADE IN SOUTH GERMANY.—*U.S. Commerce Rept. Petr. World* **21**, 193.

NEW OIL LAW IN BOLIVIA.—*Petr. World* **21**, 194.

CALIFORNIA OIL IN 1923. *Petr. World* **21**, 209.

RUSSIAN OIL POSITION 1914-1923.—*Oil Engineering and Finance* **5**, 262.

OIL DEVELOPMENTS IN ALASKA DURING 1923.—A. H. Brooks. *Am. Inst. Min. and Met. Engineer. Oil Engineering and Finance* **5**, 264.

OIL DEVELOPMENTS IN CANADA DURING 1923.—C. S. Hume. *Am. Inst. Min. and Met. Engineer. Oil Engineering and Finance* **5**, 269.

DRILLING FOR OIL IN NORTH WESTERN AUSTRALIA.—M. Terry. *Oil New* **15**, 470.

PRODUCTION STATISTICS OF THE PETROLEUM INDUSTRY.—*Financial Review, Oil Engineering and Finance* **5**, 274.

SOUTH AFRICA'S RESOURCES—TORBANITE.—*Financial News. Oil Engineering and Finance* **5**, 281.

COLOMBIAN OIL IN 1923.—V. P. Gaviria. *Oil Engineering and Finance* **5**, 282.

THE OIL SITUATION IN CALIFORNIA.—A. H. Heller. *Oil Eng. and Finance* **5**, 293.

POLAND'S OIL OUTPUT IN 1923.—*Oil News* **15**, 508.

PETROLEUM FROM CZECHOSLOVAKIA.—I. Chorkaveiv & D. Prunet. *Chim. et Ind.* **11**, 260. *J. Soc. Chem. Ind.* **43**, B362.

THE NEW PETROLEUM DISCOVERY IN GERMANY.—*Petr. Times* **11**, 660.

A VIEW OF THE FUTURE OF THE UNITED STATES OIL INDUSTRY.—D. Hagar. *Engr. and Min. Journ.-Press. Petr. Times* **11**, 687.

THE RUSSIAN PETROLEUM INDUSTRY.—*Petr. Times* **11**, 705.

THE OILFIELD OF COMODORO RIVADAVIA.—*The Lamp. Petr. Times* **11**, 725

PROPERTIES OF CALIFORNIAN CRUDE OILS.—A. J. Kraemer & H. M. Smith. *U.S. Bur. Mines Reports of Investigations* 2595. *Petr. Times* **11**, 729.

VISCOSITY OF FUEL OIL FROM PANUCO CRUDE.—R. H. Brownlee and W. H. Coburn. *Oil and Gas Jour.* **22**, (24), 84.

THE OIL RESOURCES OF THE BRITISH EMPIRE.—E. H. C. Craig. *S. Afr. Min. and Eng. Jour.* **34**, 371.

LES COMBUSTIBLES MINERAUX INDOCHINOIS.—M. Debeaupuis. *La Nature*, 1923, 390.

CALIFORNIA OIL FOR MITSUI SUPPLY SERVICE AT YOKOHAMA.—P. Faulkner. *Pacific Mar. Rev.* **20**, 437.

LES GISEMENTS DE BITUME PÉTROLIFÈRE DE MADAGASCAR.—*Le Génie Civil* **83**, 16.

RÉSULTATS DES SONDAGES EXÉCUTÉS EN LIGMAGNE POUR LA RECHERCHE DU PÉTROLE.—*Le Génie Civil* **83**, 303.

NEW SHALLOW OIL FIELD BELIEVED TO EXIST IN NORTHERN TENNESSEE.—W. R. Jillson. *Oil and Gas Jour.* **22**, (25), 74.

LE PÉTROLE DE MADAGASCAR.—A. Merle. *Ann. Mines* **3**, (12), 5. *Chim. et Ind.* **10**, 1067.

DEVELOPMENT OF THE TORRANCE OIL FIELD.—*Min. and Oil Bull.* **9**, 964

RESOURCES PÉTROLIFÈRES DE L'ANCIEN MONDE.—*La Nature* 1923, 52, 85.

ILLINOIS OIL AND GAS FIELDS SHOWN IN STATE SURVEY MAPS.—*Oil and Gas Jour.* **22**, (25), 113.

HUNDREDS OF WELLS DRILLING IN ITALY IN SEARCH FOR OIL.—*Oil and Gas Jour.* **22**, (25), 122.

ARGENTINE OIL BLOCKED BY GOVERNMENT.—*Oil and Gas J.* **22**, (24), 54.

SOUTH AFRICA AND THE PETROLEUM PROBLEM.—*S. Afr. Min. and Met. J.* **34**, 581, 613, 635.

GERMANY'S PETROLEUM INDUSTRY.—*Ind. Eng. Chem. News* **2**, (8), 11.

ROUMANIA'S PETROLEUM EXPORT TRADE.—*Moniteur du Pétrole Roumain. Petr. Times* **11**, 532.

3. Drilling and Field Operations.

Some Heat in Well Mile Deep.—C. I. O'Neill. *Petr. Age* **13**, (7), 19.

Devices for Deep Pumping.—*Petr. Age* **13**, (8), 61.

Tests Mud Fluid and Cement for Well Use.—*Oil Weekly* **32**, (10), 54.

New Method for Removing Paraffin from Oil Wells.—*Oil Weekly* **32**, (10), 75.

New Shock Absorber for Wire Line Drilling.—*Oil Tr. J.* **15**, (3), 80.

Some Methods of Dealing with Paraffin Problems in Oil Wells.—R. van A. Mills. Part 2. *Nat. Petr. News* **15**, (52), 58; **16**, (1), 67.

Conclusions on Effect of Vacuum and on Gas Separators.—J. H. Wiggins. *Nat. Petr. News* **16**, (5), 61.

New Method of Flooding Bradford Sand is now Successfully Used.—L. E. Smith. *Nat. Petr. News* **16**, (6), 37.

Production Experts Devise Methods for Subduing Wild Gasser.—A. F. Hinton. *Nat. Petr. News* **16**, (7), 45.

Most Abandonments of Trenton Rock Wells Caused by Bad Casing.—L. E. Smith. *Nat. Petr. News* **16**, (2), 21.

World's Speed Record for Drilling.—*Petr. Times* **11**, 532.

Drilling Machine put on the Market.—*Oil and Gas Jour.* **23**, (15), 78.

New Rotary Disc Bit Arousing Interest.—*Oil and Gas J.* **23**, (15), 84.

Novel Method Used to Control Notorious Gas Well at Monroe.—H. W. Bell. *Oil and Gas J.* **23**, (15), 88.

Equipment Research to Solve Problems Captain Lucey Says.—L. M. Fanning. *Oil and Gas J.* **23**, (15), 118.

Specifications for Steel and Iron Pipe.—*Oil Weekly* **32**, (11), 14.

Use of High-speed Rotary Lowers Cost of Hole.—H. Pennington. *Oil Weekly* **32**, (11), 29.

Using Electricity in California Fields.—H. N. Carroll. *Oil Weekly* **32**, (12), 31.

Promote Safety and Reduce Time Losses.—*Oil Weekly* **32**, (12), 41.

Keep Bits in Shape by Proper Treatment.—S. D. Tuthill. *Oil Weekly* **32**, (13), 21.

Many Ideas for Salvaging Casing at Humble.—G. Triplett. *Oil Weekly* **32**, (13), 29.

New Method Successful in Shutting in Gasser.—*Oil Weekly* **32**, (13), 31.

New Casinghead and Spider Proves Success.—*Oil Weekly* **32**, (13), 75.

Production Increased by New Long-stroke Pumper.—*Oil Weekly* 32, (13), 75.

MINING FOR OIL AT PECHELBRONN AND WIETZE.—C. Camsell & A. Buisson. *Oil News* **15**, 441.

THE FUNCTION OF GAS IN OIL PRODUCTION.—*Petr. Times* **11**, 603.

ROTARY-DRILLED WELL RECORDS.—E. Kraus. Am. Assoc. of Petr. Geologists. *Petr. World* **21**, 196.

THE RECOVERY OF PETROLEUM AT PECHELBRONN.—C. Camsell & A. Buisson. *Petr. Times* **11**, 635.

NEW DEVICE FOR EXTINGUISHING BURNING WELLS.—*Petr. Times* **11**, 638.

OIL FIRES EXTINGUISHED BY WATER.—*Oil Age* **21**, (4). *Oil News* **15**, 469.

A TEXT-BOOK OF PETROLEUM PRODUCTION ENGINEERING.—L. C. Uren. McGraw Hill Publishing Co., Ltd.

NATIONAL RIG IRONS.—*Petr. Times* **11**, 673.

MID-CONTINENT FIELD'S DEEPEST WELL.—*Petr. Times* **11**, 696.

CLEANING WELLS WITH FLUIDS.—L. Suverkrop. *Petr. Age* **13**, (9), 28.

ROTARY FOR DEEP WELLS.—M. T. Archer. *National Rig* (April). *Oil News* **15**, 563.

FUSION OF SEDIMENTARY ROCKS IN DRILLHOLES.—N. L. Bowen & M. Aurousseau. *Bull. Geol. Soc. Am.* **34**, 431.

DRILL STEEL; A SUBJECT OF VAST IMPORTANCE TO THE WITWATERSRAND MINES.—H. S. Brainerd. *S. Afr. Min. and Eng. J.* **34**, 317, 365, 399, 467.

PLUGGING BOREHOLES UNDERGROUND.—*Canad. Engineer* **45**, 287.

THE DRIVE METHOD OF WINNING PETROLEUM.—*Engineer* **136**, 454.

ABUSE OF WIRE ROPES.—H. M. Hall. *Oil Field Eng.* **25**, 194.

EXTRACTS FROM ADDRESS OF PRESIDENT.—H. J. Hoover. *Ohio Gas and Oil Men's J.* **5**, 5.

GASEOUS CONTENT OF GROUND WATERS AS AN AID TO THE PETROLEUM AND NATURAL GAS PROSPECTOR.—G. W. Jones, W. P. Yant & E. P. Buxton. *U.S. Bur. Mines Repts. Investigation* 2553. *Oil Weekly* **32**, (3), 13. *Petr. Times* **11**, 332.

OIL BIT WITH TWO DISCS.—R. E. Marks. *Am. Mach.* **58**, 745.

THE PARAFFIN PROBLEM IN OIL WELLS.—R. van A. Mills. *U.S. Bur. Mines Repts. Investigations* 2550.

HOW OIL COMPANIES GUARD AGAINST FIRES.—*Min. and Oil Bull.* **9**, 954.

CASING PROGRAMME USED IN LONG BEACH FIELD DEEP DRILLING PROGRAMME.—*Oil and Gas J.* **22**, (24), 123.

LE CAPTAGE DES SOURCES DE GAS NATURELS.—F. Rigaud. *La Nature* 1923, 314.

WELL SHOOTING TO INCREASE PRODUCTION.—B. A. Slenker. *Min. and Oil Bull.* **9**, 1001.

DEVICE OF OIL FIELD WORKER EFFECTIVELY CAPS BLAZING GUSHER IN TEXAS FIELD.—C. Vinson. *Oil Field Eng.* **25**, 190.

ARC WELDING OF CAST IRON.—W. N. Namack. Part I. *Oil Field Eng.* **25**, 170.

WELDING BROKEN PIPE PROCESS DESCRIBED.—*Oil and Gas J.* **22**, (24), 64.

PATENTS.

OIL WELL APPARATUS.—F. B. Jackson. U.S. Pat. 1,486,523. *Petr. Age* **13**' (8), 72.

OIL WELL PACKER.—J. S. Quigg. U.S. Pat. 1,476,727. *Petr. Age* **13**, (8), 72.

WELL CLEANER.—R. E. Carmichael. U.S. Pat. 1,484,001. *Petr. Age* **13**, (6), 72.

METHOD OF OPERATING OIL WELLS.—F. A. Howard. Standard Development Co. U.S. Pat. 1,473,348. *Petr. Age* **13**, (3), 78. *Nat. Petr. News* **16**, (2), 75.

DEVICE FOR RAISING PETROLEUM AND THE LIKE.—J. Streda. U.S. Pat. 1,482,161. *Petr. Age* 13, (8), 72.

OIL WELL HEATER.—R. C. Beck, assgnr. to Cutler-Hammer Mfg. Co. U.S. Pat. 1,477,802. *Petr. Age* **13**, (6), 72.

SUCKER-ROD HANGER.—S. E. Arey, J. H. Hern & M. S. McFadden. U.S. Pat. 1,414,541.

DRILLING BIT.—E. J. Atkins. U.S. Pat. 1,415,619.

FISHING TOOL.—D. A. Ball. U.S. Pat. 1,416,930.

OIL SAVER FOR OIL-PRODUCING WELLS.—J. L. Beard. U.S. Pat. 1,418,612.

POST FOR WELL DRILLING ROTARIES.—J. O. Bennet. U.S. Pat. 1,418,056.

APPARATUS FOR REMOVING OBSTRUCTIVE DEPOSITS IN OIL WELLS.—W. F. Booth. U.S. Pat. 1,414,171.

COUPLING DEVICE FOR OIL WELLS.—P. H. Burlin. U.S. Pat. 1,415,788.

CASING PULLING DEVICE.—G. W. Carter & R. B. Hayden. U.S. Pat. 1,418,533.

MEANS OF BORING WELLS.—M. T. Chapman. U.S. Pat. 1,420,365.

FISHING TOOL.—H. C. Cooper. U.S. Pat. 1,415,995.

WELL-ROD SOCKET.—J. A. Day. U.S. Pat. 1,416,620.

PARTING TOOL FOR WELL CASINGS.—H. C. Denning. U.S. Pat. 1,413,522.

ROTARY BIT.—A. B. Ellis. U.S. Pat. 1,411,772.

OIL-WELL PUMP.—C. D. Fator. U.S. Pat. 1,419,495.

UNDERREAMER.—B. F. Fehlman. U.S. Pat. 1,420,918.

FLOWING DEVICE FOR WELLS.—L. Friedman and D. Wallace. U.S. Pat. 1,414,402.

DEEP-WELL PUMP.—G. L. Fuller. U.S. Pat. 1,416,277.

DRILL AND REAMER COMBINED.—J. P. Fullilove. U.S. Pat. 1,411,484.

DERRICK GUY.—J. R. Gill. U.S. Pat. 1,417,728.

REAMER.—H. A. Greenlee. U.S. Pat. 1,418,255.

PITMAN CONNECTION FOR OIL-WELL APPARATUS.—E E. Greve. U.S. Pat. 1,420,033.

VALVE STRUCTURE FOR WELL INSTALLATIONS.—W. L. Gross. U.S. Pat. 1,413,909.

INCREASING THE VOLUME AND QUALITY OF OIL IN WELLS AND REMOVING THE OIL THEREFROM.—E. C. Hallmark. U.S. Pat. 1,415,552.

WELL PUMP.—H. H. Hibbard. U.S. Pat. 1,421,004.

ROTARY DRILL PIPE-SLIP.—C.C.Hosmer & C. H. Wines. U.S. Pat. 1,414,951.

ROTARY DRILL CUTTER.—H. R. Hughes. U.S. Pat. 1,412,003.

COMPOUND WALKING BEAM FOR WELL-DRILLING RIGS.—R. W. Jamison. U.S. Pat. 1,417,604.

WELL-CASING RIPPER.—J. E. Keller. U.S. Pat. 1,417,331.

COMBINED SWAB AND VALVE FOR WELLS.—B. F. Kelley. U.S. Pat. 1,421,248.

REMOVABLE DEEP-WELL PUMP.—O. B. Kibele. U.S. Pat. 1,421,253.

ROD AND PIPE GRAB FOR WELLS.—F. A. & A. L. Loman & H. C. Dean. U.S. Pat. 1,421,266.

ELECTRIC WELL-BORING TOOL.—R. M. McFaddon. U S. Pat. 1,419,068.

FISHING TOOL.—R. V. McMULLEN. U.S. Pat. 1,417,616.

SUCKER-ROD ELEVATOR.—C. M. Marshall. U.S. Pat. 1,414,519.

SWAB.—O. Mowers. U.S. Pat. 1,412,213.

UNDERREAMER.—E. H. Newkirk. U.S. Pat. 1,414,704.

OIL-WELL PUMP.—J. H. Nichols. U.S. Pat. 1,417,764.

ELECTRIC DRILLING TOOL.—R. C. Sharp. U.S. Pat. 1,419,415.

TUG WHEEL FOR OIL WELLS.—E. M. Smith. U.S. Pat. 1,413,879.

FISHING TOOL.—C. Strand. U.S. Pat. 1,418,212.

ASPHALT CUTTER.—R. J. Sweet. U.S. Pat. 1,413,630.

WELL-DRILLING MACHINERY.—E. B. Verneuil. U.S. Pat. 1,412,430.

ROTARY BORING DRILL.—F. L. O. Wadsworth. U.S. Pat. 1,417,363.

WELL CASING.—R. A. Wilson. U.S. Pat. 1,418,766.

WELL-TUBING CATCHER.—R. A. Wilson. U.S. Pat. 1,411,599.

FISHING TOOL.—R. R. Winger. U.S. Pat. 1,411,540.

WELL-CASING HEAD.—O. C. Zuck & L. O. Bacon. U.S. Pat. 1,414,320.

APPARATUS FOR EXCLUDING WATER FROM DRILLED WELLS FOR OIL.—J. C. Swan. U.S. Pat. 1,413,197.

4. PIPE-LINES, TRANSPORT AND STORAGE.

METHODS OF DECREASING EVAPORATION LOSSES OF PETROLEUM.—J. H. Wiggins. *U.S. Bur. Mines Bull.* 319. *J. Soc. Chem. Ind.* **43**, B242. *Oil News* **15**, 371.

NEW SEA-LOADING METHOD FURTHER EXPLAINED.—*Oil News* **15**, 363.

STORING VOLATILE LIQUIDS.—L. Schmidt. *U.S. Bur. Mines Report Investigations* 2547. *Chem. and Met. Eng.* **30**, 401.

HANDLING VOLATILE LIQUIDS.—*Chem. and Met. Eng.* **30**, 596.

WIDENING FIELD FOR USE OF WELDING.—G. O. Carter. *Oil and Gas J.* **23**, (15), 34.

CAST IRON PIPE IN OIL AND GAS WORK.—H. Y. Carson. *Oil and Gas J.* **23**, (15), 96.

SAFE TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES.—B. W. Dunn. U.S. Bur. of Explosives, Year ended Dec. 31, 1923. *Oil and Gas J.* **23**, (17), 72.

NEW REMOVABLE COVER PERFECTED FOR DRUMS.—*Oil and Gas J.* **23**, (17), 90.

CONCRETE TANK CONSTRUCTION AND ITS USE FOR STORAGE OF PETROLEUM.—N. Waterhouse. *Oil Engineering and Finance* **5**, 15, 75. *Chem. Abstr.* 18, 898.

FIRE FIGHTING IN THE MINERAL-OIL INDUSTRY.—R. Beythien. *Petroleum* **19**, 1173. *Chem. Abstr.* **18**, 898.

MAKING EVAPORATION AN ALLY.—C. P. Buck. *Petr. Age* **13**, (1), 18, (2), 23. *Chem. Abstr.* **18**, 898.

IMPROVEMENTS IN OIL STORAGE TANKS.—*Petr. Times* **11**, 588.

THE COMMERCIAL STORING OF VOLATILE LIQUIDS.—de Chardonnet. *Compt. rend.* **178**, 171. *Chem. Abstr.* **18**, 918.

HOW FIRE FOAM ORIGINATED.—J. C. Black. *Min. and Oil Bull.* **9**, 997.

OIL-PROOFING CONCRETE TANKS.—*Canadian Engr.* **45**, 270.

CONSTRUCTION OF CONCRETE FUEL OIL TANKS.—*Canadian Engr.* **45**, 131.

GERMAN MOTOR TANKERS FOR AMERICAN INTERESTS.—*Pacific Marine Rev.* **20**, 577.

INSTALLING OIL TANKS.—*Power* **58**, 768.

OIL RESERVOIRS AT EL SEGUNDO.—*Stan. Oil Bull.* (*Standard Oil Co. of Calif.*) **11**, (Nov.), 5.

HANDLING ASPHALT FREIGHT TRAFFIC IN LIQUID FORM.—O. C. Stein. *Good Roads* **65**, 156.

PATENTS.

FOAM MANTLE FOR PREVENTING EVAPORATION OF VOLATILE LIQUIDS.—A. B. Davis. U.S. Pat. 1,479,790. *Chem. Abstr.* **18**, 872. *J. Soc. Chem. Ind.* **43**, B210.

TANKS.—A. S. Cooper. Brit. Pat. 210,009. *Oil Engineering and Finance* **5**, 277.

APPARATUS FOR PREVENTING ESCAPE OF OIL FROM SUBMARINE TANKS.—G. Bauer and F. Kramer. U.S. Pat. 1,414,615.

FUEL STRAINER FOR TANKS.—W. E. Brock. U.S. Pat. 1,415,217.

OIL GAUGE.—C. D. Eaton. U.S. Pat. 1,413,836.

TANK FOR COMBUSTIBLE LIQUIDS.—T. S. McCahon. U.S. Pat. 1,413,043.

SAFETY APPARATUS FOR THE STORAGE AND DISTRIBUTION OF INFLAMMABLE AND OTHER LIQUIDS WITHIN TANKS AND PIPING OUT OF CONTACT WITH THE AIR.—P. A. P. V. Mauciere. U.S. Pat. 1,419,880.

OIL WELL.—J. Penrod and R. D. Thompson. U.S. Pat. 1,413,130.

FILLER ATTACHMENT FOR OIL RESERVOIRS.—F. B. Slater. U.S. Pat. 1,413,878.

5. REFINERY TECHNIQUE.

RÔLE OF ADSORPTION IN PETROLEUM REFINING.—H. L. Kauffman. *Chem. and Met. Eng.* **30**, 153. *J. Soc. Chem. Ind.* **43**, B243. *Chem. Abstr.* **18**, 1048.

REFINING AND DESULPHURISING OF OIL BY SILICA GEL.—*Petr. Times* **11**, 516.

RECOVERY OF GASOLINE FROM UNCONDENSED STILL VAPOURS.—D. B. Dow. *U.S. Bur. Mines Tech. Paper* 310. *Petr. World* **21**, 89, 136. *Oil Tr. J.* **15**, (2), 90. *Ref. and Nat. Gas. Mfr.* **3**, (2), 40. *Nat. Petr. News* **16**, (7), 53. *Petr. Times* **11**, 556. *Chem. Abstr.* **18**, 897.

THE USE OF MEASURING INSTRUMENTS IN OIL REFINING.—H. S. Bell. *Nat. Petr. News* **16**, (2), 39.

SOME PROPERTIES OF CHINA CLAY IN REFINING PETROLEUM.—*Les Matières Grasses* **17**, (Mar. 15). *Chem. Age* (*China Clay Section*) **10**, (253), 8.

CUTTING-DOWN HEAT LOSSES BY PROPER STEAM LINE INSULATION.—H. S. Bell. *Nat. Petr. News* **16**, (14), 93.

REFINERY HEAT LOSSES AND INSULATION; STILLS AND SETTINGS.—H. S. Bell. *Nat. Petr. News* **16**, (13), 62.

STABILISED GASOLINE AS PRODUCED IN A NATURAL GASOLINE PLANT.—L. F. Bayer. *Oil and Gas J.* **23**, (15), 32.

THE DISTILLATION OF PETROLEUM, ETC. A COMPREHENSIVE REVIEW.—R. Heingelmann. *Apparatebau* **35**, 69. *Chem. Abstr.* **18**, 897.

ACID-TREATING PROCESS FOR PETROLEUM PRODUCTS.—L. Gurvich. *Petroleum* **19**, 1239. *Chem. Abstr.* **18**, 897.

REFINERY CHEMIST AN IMPORTANT FACTOR.—H. T. Bennett. *Oil and Gas J.* **23**, (9), 132. *Chem. Abstr.* **18**, 898.

PROGRESS IN EMULSION TECHNIC.—K. Mischke. *Z. deut. Oel-Fett. Ind.* **43**, 679. *Chem. Abstr.* **18**, 898.

COOLING CONDENSING WATER A PROBLEM.—H. Pennington. *Ref. and Nat. Gas Mfr.* **3**, (4), 9.

REFINING PROCESS IN 1923.—I. E. Eells, C. A. Knight, and H. B. Setzler. *Petr. Age* **13**, (6), 18.

FINANCIAL CONSIDERATIONS GOVERNING THE REFINING OF MEXICAN CRUDE OIL.—J. E. Hackford. *Oil Engineering and Finance* **5**, 301.

HEAT TRANSFER SYMPOSIUM THE OUTSTANDING FEATURE OF THE A.C.S. MEETING.—*Chem. and Met. Eng.* **30**, 661.

REFINING (PETROLEUM) BY SULPHURIC ACID ABSORBED BY CAPILLARY-ACTIVE SUBSTANCES.—F. Schulz. *Petroleum* **20**, 317. *J. Soc. Chem. Ind.* **43**, B363.

HEAT TRANSMISSION FROM BARE AND INSULATED PIPES.—R. H. Heilman. *Ind. and Eng. Chem.* **16**, 451.

FORCED CONVECTION OF HEAT IN GASES AND LIQUIDS.—C. W. Rice. *Ind. and Eng. Chem.* **16**, 460.

OPTIMUM OPERATING CONDITIONS FOR PIPE HEATING AND COOLING EQUIPMENT.—W. K. Lewis, J. T. Ward, and E. Voss. *Ind. and Eng. Chem.* **16**, 467.

LOSS OF HEAT FROM FURNACE WALLS.—R. Calvert and L. Caldwell. *Ind. and Eng. Chem.* **16**, 483.

CONTACT FILTRATION IN PETROLEUM REFINING.—*Chem. and Met. Eng.* **30**, 706.

THE KIESELGUHR DEPOSITS OF THE ERMELO DISTRICT.—*S. Afr. Min. and Eng. J.* **34**, 787.

PATENTS.

PROCESS OF MAKING OILS NON-SLUDGING.—B. R. Moody. U.S. Pat. 1,473,316. *Nat. Petr. News* **16**, (2), 72.

PROCESS FOR PURIFYING LIQUIDS.—S. H. Hall, Assr. to De Laval Separator Co. U.S. Pat. 1,474,629. *Chem. Abstr.* **18**, 583. *Nat. Petr. News* **16**, (2), 75.

TO KEEP STEAM CONSTANT.—H. Hapgood, Assr. to De Laval Separator Co. U.S. Pat. 1,474,670. *Chem. Abstr.* **18**, 559. *Nat. Petr. News* **16**, (2), 75.

REMOVAL OF THE ACID CONSTITUENTS FROM TARS, TAR OILS, MINERAL OILS OR PITCHES.—F. Fischer. Ger. Pat. 375,716. *J. Soc. Chem. Ind.* **43**, B287.

TREATMENT OF LIQUID HYDROCARBONS, ESPECIALLY CRACKED SPIRIT.—F. G. P. Remfry. Brit. Pat. 212,500. *Chem. Age* **10**, 415.

REVIVIFYING FILTERING MATERIALS.—J. M. McConnell. U.S. Pat. 1,479,998. *Chem. Abstr.* **18**, 887.

PURIFYING HYDROCARBONS.—A. E. Dunstan. Brit. Pat. 204,078. *Chem. Abstr.* **18**, 899.

EXTRACTING OILS AND FATS, BUTTER—Australian Lanoline Proprietary Ltd. Brit. Pat. 205,833. *Chem. Abstr.* **18**, 1060.

SOLIDIFICATION OF ORGANIC LIQUIDS.—A. B. Ray. U.S. Pat. 1,484,190. *J. Soc. Chem. Ind.* **43**, B327. *Chem. Abstr.* **18**, 1194.

PURIFYING OILS, ETC.—Oil Refining Improvements Co., Ltd., and J. J. Hood. Brit. Pat. 206,535. *Chem. Abstr.* **18**, 1195.

REFINING HYDROCARBONS. REFINING MINERAL OILS.—H. Hütz. Ger. Pats. 385,761, 387,593. *J. Soc. Chem. Ind.* **43**, B366.

RECOVERY OF CONCENTRATED SULPHURIC ACID USED IN REFINING, AND OF THE ACID RESIN CONTAINED IN IT.—E. Benesch. Ger. Pat. 388,467. *J. Soc. Chem. Ind.* **43**, B366.

TREATMENT OF MINERAL OILS.—V. L. Oil Processes, Ltd., and O. D. Lucas Brit. Pat. 211,664. *J. Soc. Chem. Ind.* **43**, B366. *Chem. Age* **10**, 333.

SOLUTIONS OF NON-MINERAL OILS WITH MINERAL OILS, AND A PROCESS FOR THEIR MANUFACTURE.—A. G. Marshall. Brit. Pat. 211,978. *J. Soc. Chem. Ind.* **43**, B366.

PURIFYING HYDROCARBON SPIRIT.—F. G. P. Remfry. Brit. Pat. 205,868. *Chem. Abstr.* **18**, 1195.

REMOVING OIL FROM FULLER'S EARTH AND THE LIKE.—A. Wenck und Co. G.m.b.H. Ger. Pat. 385,249. *J. Soc. Chem. Ind.* **43**, B390.

METHOD OF TREATING OILS.—G. E. Heyl. Brit. Pat. 213,946. *Chem. Age.* **10**, 521. *Petr. Times* **11**, 732.

PROCESS FOR RE-ACTIVATING ADSORPTION MEDIA WITH SIMULTANEOUS RECOVERY OF THE ADSORBED PRODUCTS BY MEANS OF ELECTRICALLY GENERATED HEAT.—Naaml. Nennoots. Montaan Metallhandel, Assees. of Metallbank und Metallurgische Ges. A.-G. Brit. Pat. 207,547. *J. Soc. Chem. Ind.* **43**, B405.

APPARATUS AND METHOD OF EXTRACTING THE PETROLEUM CONTENT FROM PETROLEUM-BEARING SAND OR SHALE.—J. Coogan. U.S. Pat. 1,487,541. *J. Soc. Chem. Ind.* **43**, B410.

PROCESS OF TREATING ACID SLUDGE (FROM PETROLEUM REFINING).—E. C. Higgins, jun., and O. C. Smith, Assrs. to Conden and Co. U.S. Pat. 1,487,240. *J. Soc. Chem. Ind.* **43**, B411.

6. Natural Gas.

Manufacture of Carbon Black in the Monroe Gas Field.—*Oil Tr. J.* **15**, (3), 78.

Measurement, Compression and Transmission of Natural Gas.—L. C. Lichty. Chapman and Hall, London. John Wiley and Sons, Inc., New York.

Bureau of Standards announces Gas-Burning Appliance Tests.—G. K. Burgess. *Oil and Gas J.* **23**, (15), 72.

Comparing Gasoline Plant Operating Costs.—D. E. Foster. *Ref. and Nat. Gas. Mfr.* **3**, (4), 13.

Model Plant has Many New Features.—W. H. Hile. *Ref. and Nat. Gas. Mfr.* **3**, (4), 16.

Manufacture of Carbon-black in Canada.—T. R. Elworthy. *Chem. Age.* **10**, 439.

The Production of Helium in the United States.—W. Kauenhowen. *Petroleum* **20**, 3. *Oil Engineering and Finance* **5**, 280.

Application of Adsorbent Carbon in the Petroleum Industry.—O. L. Barnebey. Am. Chem. Soc. *Petr. Times* **11**, 674.

Carbon-black Produced from Natural Gas in 1922.—G. B. Richardson. *U.S. Geol. Surv. Min. Resources of the U.S.*, 1922, *No. II.*, 29,345.

Summary of Natural Gas Statistics, 1919–1922.—*Chem. Age* (New York) **31**, 538.

Brazed Joints for Cast-iron Gas Mains.—A. F. Bridge and M. B. Thompson. *Gas Age Record* **52**, 699.

Some Bad Practices Found in Gas Distribution.—B. R. Carney. *Gas Age Record* **52**, 767.

Thin Plate Orifice Measurement of Gas.—H. R. Pierce, W. R. Jones, M. A. Schelhardt, and H. J. Peterson. *Oil and Gas J.* **22**, (25), 82.

Ten Million Cubic Foot Gas-holder Placed in Service in San Francisco.—H. J. Smith. *Pacific Service Mag.* **15** (Oct.), 137.

New Absorption Equipment.—*Min. and Oil Bull.* **9**, 1023.

Helium.—R. B. Moore. *Aerial Age* **15**, 446.

Unsafe Domestic Appliances Discussed at Baltimore.—*Gas Age Record.* **52**, 117.

Producing Cold with Gas.—H. de W. Valentine. Am. Gas. Assoc. *Am. Gas J.* **119**, 629.

Plotting Relative Cost of Various Fuels.—R. I. Wynne-Roberts. *Canadian Eng.* **45**, 589.

Measuring Flow of Gases.—C. P. Turner and B. W. Winship. *Chem. and Met. Eng.* **30**, 633.

Patents.

Method of Recovering Gasoline. L. V. Warren. U.S. Pat. 1,484,922. *Petr. Age* **13**, (6), 72. *Ref. and Nat. Gas Mfr.* **3**, (3), 35. *J. Soc. Chem. Ind.* **43**, B366.

Valves for Controlling, Reversing and By-passing the Flow of Gas through Purifiers, Condensers and the Like.—R. Dempster and Sons, Ltd., J. E. Horsfall and H. Lumb. Brit. Pat. 211,269.

Purifying Gases Containing Hydrogen Sulphide.—A. Engelhardt. U.S. Pat. 1,479,852. *Chem. Abstr.* **18**, 872.

Separating Gas and Vapour Mixtures by Charcoal. M. Nuss. U.S. Pat. 1,481,221. *Chem. Abstr.* **18**, 1023.

Gas from Natural-gas Gasoline.—A. N. Kerr. U.S. Pat. 1,482,933. *Chem. Abstr.* **18**, 1049. *J. Soc. Chem. Ind.* **43**, B327.

Purification of Gases (from Hydrogen Sulphide, etc.).—The Koppers Co. Assees. of C. J. Ramsburg. Brit. Pat. 190,131. *J. Soc. Chem. Ind.* **43**, B327.

Carbon-black.—W. G. Laird, assgd. to H. L. Doherty. U.S. Pat. 1,490,469. *Chem. and Met. Eng.* **30**, 719.

Recovery of Hydrocarbons with Low-boiling Point from Gases Containing Them.—Allgem. Vergasungs-Ges.m.b.H. Ger. Pat. 384,106. *J. Soc. Chem. Ind.* **43**, B410.

Apparatus for Recovery of Gasoline from Casing-head Gas.—W. R. McGinnis. U.S. Pat. 1,418,876.

7. Petrol and Other Motor Fuels.

Characteristics of Gasoline on the Canadian Market.—P. V. Rosewarne. *Canad. Chem. Met.* **8**, 59.

Automobile Gasoline, Its Dangers and Tests.—A. H. Gill. *Nat. Petr. News*, Cleveland, Ohio.

Stabilised Gasoline Has Advantage in Blending.—*Ref. and Nat. Gas. Mfr.* **3**, (4), 39.

Winter Tests Show Greater Dilution with Heavy Fuels.—J. A. C. Warner. *J. Soc. Auto. Eng.* **14**, 151. *Chem. Abstr.* **18**, 1042.

Hygroscopicity of Alcohol and Alcohol Motor Fuels.—Coutant and Mariller. *Bull. assoc. chim. sucr.* **60**, 292. *Chem. Abstr.* **18**, 1043.

Radiation Characteristics of the Internal-combustion Engine.—T. Midgley and H. H. McCarthy. *J. Soc. Auto. Eng.* **14**, 182. *Chem. Abstr.* **18**, 1045.

Knockless Era in Motoring.—J. B. Rathbun. *Petr. Age* **13**, (6), **16**.

Control of Detonation.—G. A. Young and J. H. Holloway. *J. Soc. Auto. Eng.* **14**, 315. *Chem. Abstr.* **18**, 1188.

ECONOMIC MOTOR FUEL VOLATILITY.—R. Birdwell. *J. Soc. Auto. Eng.* **14**, 267. *Chem. Abstr.* **18**, 1188.

EXPLOSION LIMITS AND IGNITION TEMPERATURES OF COMBUSTIBLE LIQUIDS —H. Strache. *Oesterr. Chem.-Zeit.* **27**, 24. *J. Soc. Chem. Ind.* **43**, B364.

THE IMPORTANCE OF ANTI-DETONATING COMPOUNDS.—*Petr. Times* **11**, 662.

A THEORY OF THE MECHANISM OF THE ACTION OF ANTI-KNOCK COMPOUNDS. —F. V. Grimm and G. L. Wendt. Am. Chem. Soc. *Petr. Times*, **11**, 674.

RELATIVE EFFECTS OF SOME NITROGEN COMPOUNDS UPON DETONATION IN ENGINES.—T. A. Boyd. Am. Chem. Soc. *Petr. Times* **11**, 674.

NINTH SEMI-ANNUAL MOTOR GASOLINE SURVEY.—N. F. Le Jeune, I. H. Nelson and L. P. Calkins. *U.S. Bur. Mines Repts. Investigations* 2577.

GASOLINE DOES NOT CAUSE FORMATION OF CARBON IN CYLINDERS.—A. P. Bjerregaard. *Oil and Gas. Jour.* **22**, (25), 113.

INCREASED MILEAGE TO FOLLOW USE OF ANTI-KNOCK COMPOUND.—G. A. Burrell. *Oil and Gas. Jour.* **22**, (25), 90.

PATENTS.

MOTOR FUEL.—K. Kelley. U.S. Pat. 1,480,808. *Chem. Abstr.* **18**, 895. *Ref. and Nat. Gas. Mfr.* **3**, (2), 34. *J. Soc. Chem. Ind.* **43**, B210.

LIQUID FUEL.—J. Black. U.S. Pat. 1,480,368. *Chem. Abstr.* **18**, 895. *J. Soc. Chem. Ind.* **43**, B210.

LIQUID FUEL.—E. A. Charbonneaux. U.S. Pat. 1,480,372. *Chem. Abstr.* **18**, 895. *J. Soc. Chem. Ind.* **43**, B210.

LIQUID FUEL.—J. de Cosmo. Brit. Pat. 205,070. *Chem. Abstr.* **18**, 896.

LIQUID FUEL.—P. Lennox and J. C. Calder. Brit. Pat. 205,582. *Chem. Abstr.* **18**, 1046.

LIQUID FUEL.—Soc. Ricard, Allenet et Cie. Brit. Pat. 206,516. *Chem. Abstr.* **18**, 1191.

MOTOR SPIRIT.—A. E. Dunstan and F. B. Thole. Brit. Pat. 205,367. *Chem. Abstr.* **18**, 1191.

MOTOR SPIRIT.—G. Scaravelli. Brit. Pat. 206,147. *Chem. Abstr.* **18**, 1191.

PROCESS FOR OPERATING INTERNAL-COMBUSTION ENGINES.—E. Fischer. Ger. Pat. 365,115. *J. Soc. Chem. Ind.* **43**, B366.

PROCESS OF MANUFACTURING ALCOHOL-ETHER MIXTURES (FOR USE AS MOTOR FUEL).—F. E. Lichenthaeler. U.S. Pat. 1,488,605.

MOTOR FUEL.—E. W. Stevens. U.S. Pat. 1,414,759.

10. LUBRICANTS AND LUBRICATION.

STEAM POWER PLANT PRIME MOVERS AND THEIR LUBRICATION.—*Lubrication* **9**, 121.

LUBRICATION IN THE PRINTING INDUSTRY.—*Lubrication* **9**, 133.

THE HANDBOOK OF INDUSTRIAL OIL ENGINEERING.—J. B. Lippincott Co., Philadelphia.

A SIMPLIFIED METHOD FOR MAKING LUBRICATING OIL EMULSIONS.—A. M. Burroughs and W. M. Grube. *J. Econ. Entomol.* **16**, 534. *Chem. Abstr.* **19**, 1028.

LUBRICANTS FROM VEGETABLE AND MINERAL OILS.—G. Triplett. *Ref. and Nat. Gas. Mfr.* **3**, (2), 23. *Chem. Abstr.* **18**, 1049.

THE FUNCTION OF LUBRICANTS.—A. L. Clayden. *J. Soc. Auto. Eng.* **14**, 312.

MECHANICAL FRICTION AS AFFECTED BY THE LUBRICANT.—L. H. Pomeroy. *J. Soc. Auto. Eng.* **14**, 307. *Chem. Abstr.* **18**, 1193.

SOME NOTES ON THE LUBRICATION OF GAS WORKS PLANT.—W. T. Tupholme. *Gas J.* **165**, 490. *Chem. and Met. Eng.* **30**, 522.

DETERIORATION OF TWELVE TURBINE OILS IN USE.—A. Duckham and S. E. Bowrey. *Engineering* **116**, 353.

LUBRICATING OILS FOR INTERNAL-COMBUSTION ENGINES.—R. J. Steward. *Power* **58**, 959.

A NEW LUBRICATION DEVELOPMENT.—D. W. Dickie. *Pacific Mar. Rev.* **20**, 451.

INDUSTRIAL LUBRICATION.—Acheson Graphite Co., Niagara Falls, N.Y.

PATENTS.

LUBRICANTS FOR MACHINERY; MINERAL AND TAR OILS.—M. J. Heitman. Brit. Pat. 209,060. *Oil Engineering and Finance* **5**, 230.

LUBRICATING.—A. M. Tucker. Brit. Pat. 201,583. *Chem. Abstr.* **18**, 1049.

LUBRICANTS.—J. Pearlman. Brit. Pat. 206,706. *Chem. Abstr.* **18**, 1195.

11. FUEL OIL.

OIL FUEL BURNING AT SEA AND ON LAND.—J. S. GANDER. James Munro and Co., Ltd., Glasgow.

EFFICIENT USE OF LIQUID FUEL.—H. A. Anderson. *Foundry* **52**, 29. *Chem. Abstr.* **18**, 893.

KÖRTING FIRING WITH LIQUID FUELS.—Pradel. *Apparatebau* **35**, 49.

CHECKING LOSSES IN BURNING FUEL OIL.—C. A. Wendt. *Oil and Gas Jour.* **23**, (17), 104.

HEAVY BURNING OILS.—Anguenot, H. Gault and F. Vlès. *Mat. grasses* **15**, 6626; **16**, 6657. *Chem. Abstr.* **18**, 1047.

PRODUCTION OF ASPHALTIC CRUDES TO MEET FUEL REQUIREMENTS.—G. Howell. *Oil Engineering and Finance* **5**, 271.

WILL FUEL OIL SOLVE HEATING PROBLEM?—*Oil Engineering and Finance* **5**, 287.

COMBUSTION DEVICES FOR LIQUID FUEL.—I, II and III. W. Trinks. *Fuels and Furnaces* **2**, 21, 135, 255. *Chem. Abstr.* **18**, 1188.

PULVERISED AND COLLOIDAL FUEL.—J. T. Dunn. Ernest Benn, Ltd., London.

COAL VERSUS OIL.—A. D. Little, Inc., Cambridge, Mass.

FUEL OIL BURNING.—Todd Oil Burning and Eng. Corp., New York.

OIL-BURNING INSTALLATIONS.—C. C. Pounder. Emmott and Co., Ltd., Manchester and London.

CHEMISTRY OF COMBUSTION OF OIL AND GAS.—L. Balliet. *Oil and Gas Jour.* **22**, (25), 23.

WILL IT PAY TO BURN OIL INSTEAD OF COAL ?—W. F. Schaphorst. *Pacific Mar. Rev.* **20**, 422.

PROGRESS IN MARINE PROPULSION.—*Engineering* **116**, 149.

FUEL CONSERVATION AND WASTEFULNESS IN ITS USE.—R. H. Fernold. *Gas Age Record* **52**, 673.

THE FUTURE OF FUEL OIL.—H. W. Camp. *Petr. Age* **13**, (6), 73, (8), 25.

12. DIESEL OIL AND ENGINES.

EFFECT OF ALTITUDE AND TEMPERATURE ON OIL-ENGINE POWERS.—C. Day. Inst. of Elec. Engineers. *Oil News* **15**, 365.

WORKING COSTS OF HEAVY-OIL ENGINES.—H. Moore. *Oil Engineering and Finance* **5**, 241.

THE OIL ENGINE.—J. L. Chaloner. *Oil Engineering and Finance* **5**, 251.

HEAVY-OIL ENGINE INDICATOR DIAGRAMS.—J. M. Ferguson. Diesel Engine Users Assoc. *Oil Engineering and Finance* **5**, 253. *Petr. World* **21**, 200.

FUELS FOR DIESEL ENGINES.—*Petr. Times* **11**, 606.

THE CHOICE OF HEAVY FUELS FOR USE IN DIESEL ENGINES.—J. E. Hackford. *Oil Engineering and Finance* **5**, 283.

MOTOR SHIPS REDUCE THE COST OF LONG VOYAGES.—A. B. Homer. *Marine Eng.* **28**, 678.

FIRST BRITISH-BUILT DIESEL ELECTRIC SHIP COMPLETES TRIALS.—*Marine Eng.* **28**, 706.

CLYDE MARINE OIL ENGINES.—A. L. Mellanby. *Engineering* **116**, 128.

THE SOLID-INJECTION OIL ENGINE.—H. F. Shepherd. *Power* **58**, 946.

OIL-ENGINE SPRAY NOZZLES.—H. F. Shepherd. *Power* **56**, 854.

13. PLANT AND MACHINERY.

REPORT SAYS CALORISED TUBES SAVE MONEY FOR REFINER.—R. Langley. *Nat. Petr. News* **16**, (5), 88.

THE "MOORE-BURMAH" OIL COOLER.—*Petr. Times* **11**, 547.

NEW OIL BURNER FOR FIELD BOILERS FOUND SUCCESSFUL.—*Oil Weekly* **32**, (11), 75.

California Tendency Toward Better Yields.—C. J. von Bibra. *Ref. and Nat. Gas Mfr.* **3**, (4), 25.

The Design of Oil Distillation Equipment.—E. H. Leslie. *Oil News (U.S.A.)* **12**, (2), 12. *Chem. Abstr.* **18**, 1047.

Coen System of Low-pressure Mechanical Oil Burning.—Bulletin M. Coen Co., Inc., New York.

Foster Heaters and Oil Refineries. Bulletin 241. Power Specialty Co., New York.

The "Rocket" Oil Separator.—*Engineering* **116**, 492.

The Vickers Centrifugal Oil Separator.—*Engineering* **116**, 309.

New Stream-line Filter.—G. W. Fuller. *Canad. Eng.* **45**, 545.

Oil Separator.—*Times Engr. Supplement* **13**, 143.

The Purification of Used Lubricating Oils.—*Pacific Mar. Rev.* **20**, 398.

Reclaiming Oil from Vapour in Turbine Bearings.—*Power* **58**, 777.

Oil Purification by the Continuous By-pass Method.—J. V. Shepherd. *Pacific Mar. Rev.* 20, 148.

The Commer Paraffin Carburettor.—*Engineering* **116**, 185.

Is the Liberty Engine "Obsolescent"?—L. D. Seymour. *Aerial Age* **16**, 174.

Patents.

Method and Apparatus for Atomising and Burning Fuel Oil.—E. A. Reid. U.S. Pat. 1,478,255. *Petr. Age* **13**, (8), 72.

Oil Burner.—G. B. Lear. U.S. Pat. 1,484,993. *Petr. Age* **13**, (6), 72.

Burner for Petrol Gases and the Like.—H. E. Smith. U.S. Pat. 1,485,129. *Petr. Age* **13**, (6), 72.

Apparatus for the Recovery and Refining of Light Hydrocarbon Oils and Gases from Oil Wells.—W. J. Knox and A. R. Speer. U.S. Pat. 1,484,718. *Petr. Age* **13**, (6), 72.

Apparatus for Exchange of Heat Between Two Fluids.—R. Matteucci. Brit. Pat. 209,993. *J. Soc. Chem. Ind.* **43**, B239.

Centrifugal Machine for the Production of Emulsions, Colloidal Solutions and the Like.—T. F. Westenholz and J. E. Lyrop. Brit. Pat. 210,023. *J. Soc. Chem. Ind.* **43**, B239.

Continuous Production of Emulsions, Suspensions and Similar Disperse Systems.—C. A. Agthe. Brit. Pat. 210,307. *J. Soc. Chem. Ind.* **43**, B239.

Method of and Apparatus for Separating Out and Removing Matter Suspended in a Fluid.—H. S. Hele-Shaw. Brit. Pats. 210,101 and 210,376. *J. Soc. Chem. Ind.* **43**, B239.

Film Evaporations.—Soc. des Etablissments Barbet. Brit. Pat. 208,175. *Oil Engineering and Finance* **5**, 229.

CENTRIFUGAL SEPARATORS.—Aktiebolaget Separator. Brit. Pat. 204,046. *J. Soc. Chem. Ind.* **43**, B282.

SEPARATION OF LIQUID MIXTURES BY DISTILLATION.—Chem. Fabr. vorm. Weiler-ter Meer. Ger. Pat. 387,524. *J. Soc. Chem. Ind.* **43**, B283.

APPARATUS FOR CONDENSING DISTILLED VAPOURS.—G. de Bethune. Brit. Pat. 197,341.

SEPARATION OF OIL FROM WATER.—Vickers, Ltd., and J. McKechnie. Brit. Pat. 211, 352.

FILTER FOR LIQUID FUELS OR OTHER LIQUIDS.—A. E. Bass. U.S. Pat. 1,481,407. *Chem. Abstr.* **18**, 770.

FILTER FOR PURIFYING OILS.—W. W. Nugent. U.S. Pat. 1,481,525. *Petr. Age* **13**, (4), 62. *Chem. Abstr.* **18**, 770. *Ref. and Nat. Gas. Mfr.* **3**, (2), 34.

LIQUID FUEL FURNACE ADAPTED FOR METALLURGICAL PROCESSES.—F. M. Allen. U.S. Pat. 1,480,361.

APPARATUS AND METHOD OF EXTRACTING THE PETROLEUM CONTENT FROM PETROLEUM-BEARING SAND OR SHALE.—J. Coogan. U.S. Pat. 1,487,541. *Ref. and Nat. Gas. Mfr.* **3**, (4), 37. *Petr. Age* **13**, (8), 72.

OBTAINING SATURATED HYDROCARBONS FROM CRUDE PETROLEUM.—A. Schwarz. Brit. Pat. 211,487. *Chem. Age* **10**, 446.

FILTER FOR HEAVY FUEL OIL OR OTHER LIQUIDS.—W. T. Price. U.S. Pat. 1,483,111.

PUMP FOR INFLAMMABLE LIQUIDS.—H. Mueller. Norw. Pat. 38,017. *Chem. Abstr.* **18**, 920.

COMBINED HYDROMETER AND LIQUID-LEVEL GAUGE.—V. C. Kloepper. U.S. Pat. 1,482,852. *Chem. Abstr.* **18**, 920.

DISTILLING OIL.—C. H. Leach. Brit. Pat. 211,882. *Chem. Age* **10**, 470.

APPARATUS FOR CLARIFYING GASOLINE OR SIMILAR LIQUIDS.—L. J. Archambault. U.S. Pat. 1,483,266. *Chem. Abstr.* **18**, 1049.

CHOKE NIPPLE FOR OIL LINES.—M. J. Heald. U.S. Pat. 1,485,264. *Petr. Age* **13**, (6), 72.

RETORTS OR STILLS (FOR MINERAL OILS).—F. Lamplough and N. C. T. Harper. Brit. Pat. 211,219. *Chem. Age* **10**, 299. *J. Soc. Chem. Ind.* **43**, B326.

PROCESS AND MEANS FOR PREVENTING ONE OF TWO CENTRIFUGALLY SEPARATED LIQUIDS FROM CONTAMINATING THE OTHER.—E. A. Forsberg, Assr. to The De Laval Separator Co. U.S. Pat. 1,485,177.

SEPARATING LIQUIDS OF DIFFERENT SPECIFIC GRAVITIES.—R. C. Knight and H. D. Smith. Brit. Pat. 211,717.

DISTILLING MINERAL OILS, ETC.—K. Fuchs. Brit. Pat. 209,771. *Chem. Age* **10**, 300. *Oil Engineering and Finance* **5**, 277.

APPARATUS FOR THE RECOVERY AND REFINING OF LIGHT HYDROCARBON OILS AND GASES FROM OIL WELLS.—W. J. Knox, Assr. to A. R. Speer. U.S. Pat. 1,484,718. *J. Soc. Chem. Ind.* **43**, B366.

EMULSIFYING APPARATUS.—A. Sonsthagen, J. L. Wood and Kenook Co. Ltd. Brit. Pat. 212,642. *J. Soc. Chem. Ind.* **43**, B405.

CENTRIFUGAL MACHINE (FOR THE TREATMENT OF TRANSFORMER OILS).—C. E. Unger, Assr. to Industrial Products Co. U.S. Pat. 1,482,418. *J. Soc. Chem. Ind.* **43**, B406.

CONDENSER.—A. K. Whitelaw, Assr. to Standard Oil Co., of Kentucky. U.S. Pat. 1,488,422. *J. Soc. Chem. Ind.* **43**, B407.

PROCESS FOR THE CONTINUOUS VAPORISATION OF MIXTURES CONTAINING HYDROCARBONS.—"Metan" Spólka z. Ograniczona Adp. Ger. Pat. 379,964. *J. Soc. Chem. Ind.* **43**, B411.

LIQUID-FUEL METER.—H. A. Anderson. U.S. Pat. 1,412,263.

OIL-WELL ATTACHMENT.—W. E. Hancock. U.S. Pat. 1,412,863.

VACUUM SAMPLER FOR TANKS OF REFINED OIL AND GASOLINE.—C. E. Johnson. U.S. Pat. 1,416,354.

GASOLINE METER.—R. Lossing. U.S. Pat. 1,414,964.

APPARATUS FOR PUMPING OIL.—J. D. Nixon. U.S. Pat. 1,412,886.

OIL-TREATING MIXER.—M. Belcher. U.S. Pat. 1,417,965.

OIL HEATER FOR TOPPING STILLS.—J. E. Bell. U.S. Pat. 1,418,272.

SEPARATING AND TOPPING HYDROCARBONS FROM A WATER MIXTURE.—W. A. Brown. U.S. Pat. 1,419,610.

DISTILLING CRUDE PETROLEUM AND PRODUCT THEREOF.—E. M. Clark. U.S. Pat. 1,413,260.

APPARATUS FOR DEHYDRATING OIL.—S. A. Giebner. U.S. Pat. 1,414,079.

PURIFIER FOR LUBRICATING OILS.—E. E. Hans. U.S. Pat. 1,420,837.

FILTER.—G. Knock. U.S. Pat. 1,414,137.

CENTRIFUGAL OIL PURIFIER.—M. Leitch. U.S. Pat. 1,415,881.

CENTRIFUGAL FILTER.—T. H. Parker, S. G. Gassaway and J. W. Whitson. U.S. Pat. 1,411,582.

OIL SEPARATOR.—J. G. Pool. U.S. Pat. 1,418,970.

CARBURETTOR FOR INTERNAL-COMBUSTION ENGINES.—W. H. Anderson. U.S. Pat. 1,415,423.

REGENERATOR OR VAPORISER FOR INTERNAL-COMBUSTION ENGINES.—F. T. Armstrong. U.S. Pat. 1,413,564.

OIL DISCHARGE JET.—H. F. Blackburn and W. J. Cummings. U.S. Pat. 1,412,267.

VAPORISING DEVICE FOR FUEL OILS.—R. L. Bowman. U.S. Pat. 1,416,938.

LIQUID VAPORISER.—E. Cleary. U.S. Pat. 1,418,234.

CARBURETTOR.—W. H. Collier. U.S. Pat. 1,417,501.

CARBURETTOR.—J. J. Cox and R. Wendelken. U.S. Pat. 1,414,935.

AIR HEATER AND MOISTURE SUPPLY FOR CARBURETTORS.—S. R. DuBrie. U.S. Pat. 1,419,239.

CARBURETTOR.—H. G. Duncan. U.S. Pat. 1,413,107.

CARBURETTOR.—W. A. Edwards. U.S. Pat. 1,411,426.

CARBURETTOR.—J. M. Flannery and F. C. Dettelbach. U.S. Pat. 1,419,035.

AUTOMATIC CARBURETTOR CONTROL.—S. E. Foreman. U.S. Pat. 1,419,963.

CARBURETTOR FOR INTERNAL-COMBUSTION ENGINES.—N. Garoff. U.S. Pat. 1,420,090.

DEVICE FOR PREVENTING BACKFIRE IN THE CARBURETTOR OR INLET PIPE OF INTERNAL-COMBUSTION ENGINES.—W. E. Collogly. U.S. Pat. 1,414,081.

KEROSENE CARBURETTOR.—J. J. Hawxhurst. U.S. Pat. 1,412,000.

AIR-INLET-CONTROL DEVICE FOR CARBURETTORS.—V. R. Heftler. U.S. Pat. 1,418,259.

CARBURETTOR.—E. G. Hodges. U.S. Pat. 1,413,985.

FUEL VAPORISER.—W. Martin. U.S. Pat. 1,411,575.

CARBURETTOR.—G. J. Mayer. U.S. Pat. 1,414,035.

CARBURETTOR.—F. C. Mock. U.S. Pat. 1,416,857–8.

CRUDE-OIL-BURNING FURNACE.—R. Moeller and O. Otterson. U.S. Pat. 1,417,092.

CARBURETTOR.—J. T. Peterson. U.S. Pat. 1,412,487.

CARBURETTOR HEATER.—C. R. Piggins and W. C. Hanson. U.S. Pat. 1,413,681.

CARBURETTOR.—C. L. Rayfield. U.S. Pat. 1,412,259.

CARBURETTOR.—A. G. Redmond. U.S. Pat. 1,412,137.

CARBURETTOR.—H. B. Simmons. U.S. Pat. 1,418,100.

CARBURETTOR AND FUEL FEED.—C. L. Stokes. U.S. Pat. 1,420,886.

CARBURETTOR.—R. H. Taylor. U.S. Pat. 1,419,993.

CARBURETTOR.—E. F. Utz. U.S. Pat. 1,416,913.

CARBURETTOR.—S. D. Walden. U.S. Pat. 1,418,756.

CARBURETTOR.—F. G. Washburn. U.S. Pat. 1,418,499.

CARBURETTOR.—R. Woldelkin. U.S. Pat. 1,413,440.

CARBURETTOR.—W. E. Wilson. U.S. Pat. 1,420,356.

VAPORISER.—C. Wittenmyer. U.S. Pat. 1,416,151.

14. Testing, Analysis and Apparatus.

A Mercurial Viscosimeter Compensated for Density.—F. M. Lidstone. *J. Soc. Chem. Ind.* **43**, 87T.

United States Government Specification for Lubricants and Liquid Fuels and Methods for Testing.—*U.S. Bur. Mines Tech. Paper* 323A. *Petr. Times* **11**, 528. *Oil and Gas J.* **23**, (17), 102.

Calorific Value of Liquid Fuels.—G. Morpurgo. *Mitt. Staatl. Techn. Versuchsamts* **10**, 97. *Chem. Zentr.* **95**, I, 271. *J. Soc. Chem. Ind.* **43**, B285.

Estimation of Latent Heats of Vaporisation of Liquids at High Pressures.—W. H. McAdams and J. C. Morrell. *Ind. Eng. Chem.* **16**, 375.

Fractional Distillation of Small Quantities.—G. Widmer. *Helv. Chim. Acta* **7**, 59. *J. Soc. Chem. Ind.* **43**, B316. *Chem. Abstr.* **18**, 1069.

Separation of the Components of Petroleum. I.—Industrial Processes. II.—(*a*) Physical Conditions; (*b*) Fractional Precipitation. III.—Surface Tension.—P. F. Gordon. *J. Soc. Chem. Ind.* **42**, 405. *Chem. Abstr.* **18**, 898.

Developments in the Field of Mineral oil Analysis and the Mineral Oil Industry as Well as Oil Shale Investigations in the Year 1920-1921.—L. Singer. *Petroleum* **19**, 571, 724, 803, 835, 969, 1001, 1038, 1069, 1110, 1170, 1208, 1243, 1278.

Separation of the Components of Petroleum. IV.—Preliminary Communication.—P. F. Gordon and C. C. Middleton. *J. Soc. Chem. Ind.* **42**, 413T. *Chem. Abstr.* **18**, 898.

Determination of Naphthenic Acid in Soaps.—B. Tûtunnikoff. *Seifensieder-Zeit.* **50**, 603. *Chem. Abstr.* **18**, 913.

Determination of Naphthenic Acid.—J. Davidson. *Seifensieder Zeit.* **51**, 2. *Chem. Abstr.* **18**, 913.

The Measurement of the Surface Tension of a Small Quantity of Liquid.—A. Ferguson. *Proc. Phys. Soc. London* **36**, 37. *Chem. Abstr.* **17**, 924.

An Electrical Fuse for a Calorimetric Bomb.—P. V. Zolatarev. *Bull. Inst. Polytech. Ivanovo-Voznesensk.* **7**, 117. *Chem. Abstr.* **18**, 918.

Uniformity in Hydrometer Design.—W. Block. *Z. angew. Chem.* **37**, 11. *Chem. Abstr.* **18**, 918.

A New Combined Viscometer and Plastometer.—E. C. Bingham and H. A. Murray. *Proc. Am. Soc. Testing Materials* **23**, II., 655. *Chem. Abstr.* **18**, 919.

The Principle of a General Method of Determining the Calorific Capacity of Solids and Liquids. Application to the Determination of the Water Value of Calorimetric Bombs.—C. Moureu, C. Dufraisse and P. Landrieu. *Compt. rend.* **176**, 1513. *Chem. Abstr.* **18**, 933.

The Measurement of Consistency with Particular Application to Greases and Petroleum.—R. E. Wilson and F. R. Baxter. *Proc. Am. Soc. Testing Materials* **23**, II., 453. *Chem. Abstr.* **18**, 1022.

SEPARATION OF ASPHALTENES FROM MINERAL OILS BY CYCLOHEXANE.—M. Jakes. *Chem.-Zeit.* **47**, 757. *Chem. Abstr.* **18**, 1047.

CALORIMETRIC MICROBOMB (PRELIMINARY NOTE).—M. Padoa and B. Foresti. *Gazz. Chim. Ital.* **53**, 493. *Chem. Abstr.* **18**, 1069.

REPORT OF SUB-COMMITTEE XVI. OF COMMITTEE D-2 ON CLOUD AND POUR TEST.—R. R. Matthews. *Proc. Am. Soc. Testing Materials* **23**, I., 382. *Chem. Abstr.* **18**, 1187.

THE DETERMINATION OF THE UNSATURATED AND AROMATIC CONSTITUENTS OF LOW-TEMPERATURE TAR.—H. Arnold. *Z. angew. Chem.* **36**, 545. *Chem. Abstr.* **18**, 1190.

REPORT OF COMMITTEE D-2 ON PETROLEUM PRODUCTS AND LUBRICANTS.—C. P. Van Gundy. *Proc. Am. Soc. Testing Materials* **23**, I., 343. *Chem. Abstr.* **18**, 1192.

PROPOSED METHOD FOR SAMPLING PETROLEUM PRODUCTS—LIQUID OILS FROM TANK BOATS OR BARGES, SHORE-TANKS OR CARS.—*Proc. Am. Soc. Testing Materials* **23**, I., 380.

PROPOSED BURNING TEST FOR KEROSENE OILS.—*Proc. Am. Soc. Testing Materials* **23**, I., 388.

METHOD FOR DETERMINATION OF SLUDGING PROPERTIES OF TRANSFORMER OILS.—E. A. Snyder. *Proc. Am. Soc. Testing Materials* **23**, I., 448. *Chem. Abstr.* **18**, 1193.

METHOD FOR DETERMINING SLUDGING PROPERTIES OF TRANSFORMER OILS.—*Proc. Am. Soc. Testing Materials* **23**, I., 451. *Chem. Abstr.* **18**, 1193.

METHOD OF MEASURING THE EMULSIFYING TENDENCY OF LUBRICATING OILS, BASED ON SURFACE TENSION.—H. Dimmig. *Proc. Am. Soc. Testing Materials* **23**, I., 363. *Chem. Abstr.* **18**, 1193.

TESTING OF PETROLEUM OILS FOR GASIFICATION.—A. Holmes. *Ind. Eng. Chem.* **16**, 258. *J. Soc. Chem. Ind.* **43**, B363. *Chem. Abstr.* **18**, 1047.

DETERMINATION OF THE VISCOSITY OF HIGHLY VISCOUS SUBSTANCES (*e.g.*, CYLINDER OILS).—E. Berl, M. Isler, and A. Lange. *Z. angew. Chem.* **37**, 128. *J. Soc. Chem. Ind.* **43**, B364.

THE BICHROMATE NUMBER OF PETROLEUM OILS.—C. E. Waters. Am. Chem. Soc. *Petr. Times* **11**, 674.

THE VISCOSITY OF OILS AT HIGH TEMPERATURES.—A. F. Fortsch and R. E. Wilson. *Petr. Times* **11**, 674.

DEW-POINTS OF GASOLINE-AIR MIXTURES.—R. E. Wilson and D. P. Barnard. Am. Chem. Soc. *Petr. Times* **11**, 674.

A BOILING-POINT CORRECTION CHART FOR NORMAL LIQUIDS WITH SPECIAL APPLICATION TO PETROLEUM PRODUCTS.—W. H. Bahlke and R. E. Wilson. Am. Chem. Soc. *Petr. Times* **11**, 674.

TESTING DECOLORISING CARBONS.—J. E. Teeple and P. Mahler. *Ind. and Eng. Chem.* **16**, 498.

LUBRICANTS AND HOW TO TEST THEM.—E. Andrews. *Power* **58**, 430.

A Method for the Estimation of the Colour of Oils.—D. C. Cox. *Am. Soc. Test. Mat. Tech. Papers* **23**, (2), 416.

The Determination of the Calorific Value of Liquid Fuels.—N. Harwood. *Engineering* **116**, 396.

Tests for Asphalt Cement for Asphalt Macadam, Asphaltic Concrete and Sheet Asphalt Pavements.—P. Hubbard. *Canad. Eng.* **45**, 376, 484.

Testing Bearing Metals and Lubricants.—M. F. J. Taylor. *Am. Mach.*, **58**, 700.

Testing and Valuation of Gas Oil Report.—C. A. Lunn. *Gas Age Record* **52**, 491.

The "MacDonald" Portable Gas Analysis Apparatus.—D. M. MacDonald. *Gas J.* **164**, 779.

Tests for Asphaltic Oils.—I. M. Shaw. *Canad. Eng.* **45**, 404.

Reliable Plant Viscosimeter.—M. Marasco. *Ind. and Eng. Chem.* **16**, 172. *J. Soc. Chem. Ind.* **43**, B237.

Patents.

Calorimetric Bombs.—J. Darroch. Brit. Pat. 208, 492. *J. Soc. Chem. Ind.* **43**, B320.

Gas Calorimeters.—J. F. Simmance. Brit. Pat. 210,950. *J. Soc. Chem. Ind.* **43**, B357.

Gas-analysis Apparatus.—F. F. Uehling. U.S. Pat. 1,480,317. *J. Soc. Chem. Ind.* 43, B358.

Apparatus for Determining and also Indicating the Total Available Heat of a Flow of Combustible Fluid.—H. N. Packard, Assr. to The Cutler Hammer Manuf. Co. U.S. Pat, 1,482,091. *Chem. Abstr.* **18**, B358.

15. Cracking and Hydrogenation.

Cross Cracking Process.—J. B. Rathbun. *Petr. Age* **13**, (8), 69.

Ferrous Selenide as a Contact Catalyst for Cracking.—T. Midgley and C. A. Hochwalt. *Ind. and Eng. Chem.* **16**, 365.

A Catalytic Method of Obtaining Motor Spirit.—E. Rabinowitsch. *Brennstoff-Chem. Petr. Times* **11**, 550.

Simultaneous Skimming and Cracking.—G. Egloff. *Oil and Gas J.* **23**, (17), 68.

Hydrogenation of Tars, Mineral Oils and Coal.—J. H. Frydlender. *Rev. prod. chim.* **26**, 609. *Chem. Abstr.* **18**, 895.

Obtaining Benzine and Lubricating Oil by the Blümner Process.—O. Arendt. *Petroleum* **19**, 1285. *Chem. Abstr.* **18**, 897.

Converting Smackover Crude into Gasoline.—G. Egloff. *Ref. and Nat. Gas Mfr.* **3**, (4), 41.

THE CRACKING OF WAX DISTILLATE OIL.—G. Egloff. *Oil Age* **21**, (2), 16. *Chem. Abstr.* **18**, 1047.

THE PYROGENETIC DISSOCIATION OF ACYCLIC HYDROCARBONS.—H. Gault, F. A. Heusel, and Y. Altchidjan. *Compt. rend.* **178**, 1562.

THE DUBBS CRACKING PROCESS.—G. Egloff. *Min. and Oil Bull.* **9**, 1027.

PATENTS.

METHOD AND APPARATUS FOR REFINING HYDROCARBONS.—C. R. Burke, assgnr. to L. P. Burke. U.S. Pat. 1,487,438. *Petr. Age* **13**, (8), 72. *Ref. and Nat. Gas Mfr.* **3**, (4), 37. *J. Soc. Chem. Ind.* **43**, B410.

OIL-CONVERTING APPARATUS FOR THE CONVERSION AND TRANSFORMATION OF OILS.—J. H. Adams, assgnr. to The Texas Co. U.S. Pat. 1,477,860. *Petr. Age* **13**, (8), 72. *Ref. and Nat. Gas Mfr.* **3**, (1), 31. *J. Soc. Chem. Ind.* **43**, B124. *Chem. Abstr.* **18**, 900.

ART OF TREATING OILS.—E. M. Clark and N. E. Loomis, assgnrs. to Standard Development Co. U.S. Pat. 1,478,102. *Petr. Age* **13**, (8), 72. *Ref. and Nat. Gas Mfr.* **3**, (1), 21. *J. Soc. Chem. Ind.* **43**, B165. *Chem. Abstr.* **18**, 751.

CRACKING.—C. P. Dubbs, assgnr. to Universal Oil Products Co. U.S. Pat. 1,484,445. *Petr. Age* **13**, (6), 70. *J. Soc. Chem. Ind.* **43**, B327. *Chem. Abstr.* **18**, 1194.

OIL GAS: CARBURETTING APPARATUS.—J. F. Monnot. Brit. Pat. 208,310. *Chem. Age* **10**, 99. *J. Soc. Chem. Ind.* **43**, B124. *Oil Engineering and Finance* **5**, 229.

PROCESS OF PRODUCING LOW BOILING OILS.—G. I. Pritchard and H. Henderson. Gulf Refining Co. U.S. Pat. 1,473,316. *Nat. Petr. News* **16**, (2), 72. *Chem. Abstr.* **18**, 466.

PROCESS OF REFINING OIL. C.B. Forward, U.S. Pat. 1,473,402. *Nat. Pat. News* **16**, (2), 72.

DISTILLING AND CRACKING PETROLEUM.—J. L. Gray. U.S. Pat. 1,474,147. *Nat. Petr. News* **16**, (2), 72. *Chem. Abstr.* **18**, 465. *J. Soc. Chem. Ind.* **43**, B47. *Petr. Age* **12**, (12), 72.

METHOD OF TREATING PETROLEUM VAPOUR.—D. W. Hoge. U.S. Pat. 1,474,476. *Nat. Petr. News* **16**, (2), 72.

METHOD OF TREATING PETROLEUM.—Bash Oil and Refining Co. U.S. Pat. 1,474,475. *Nat. Petr. News* **16**, (2), 72.

CONTINUOUS METHOD OF CRACKING HYDROCARBON OILS.—E. O. Linton, Assr. to Linton Gasoline Process Co. U.S. Pat. 1,484,513. *Chem. Abstr.* **18**, 1194.

CRACKING OILS.—W. J. Reilly. U.S. Pat. 1,479,833. *Petr. Age*, **12**, (5), 52. *Ref. and Nat. Gas Mfr.* **3**, (2), 33. *J. Soc. Chem. Ind.* **43**, B210. *Chem. Abstr.* **18**, 899.

CRACKING HYDROCARBON OILS.—F. E. Wellman. U.S. Pat. 1,478,413. *Ref. and Nat. Gas Mfr.* **3**, (1), 31. *J. Soc. Chem. Ind.*, **43**, B166. *Chem. Abstr.* **18**, 899.

CRACKING HYDROCARBON OILS.—G. EGLOFF. U.S. Pat. 1,478,559. *Ref. and Nat. Gas Mfr.* **3**, (1), 33. *J. Soc. Chem. Ind.* **43**, B166. *Chem. Abstr.* **18**, 899.

A PROCESS FOR TREATING PETROLEUM.—C. P. Dubbs, assgnr. to Universal Oil Products Co. U.S. Pat. 1,488,325. *Ref. and Nat. Gas Mfr.* **3**, (4), 37.

PROCESS AND APPARATUS FOR MOLECULAR CONVERSION OF HYDROCARBON OILS AND THE SEPARATION OF RESULTANT PRODUCTS.—G. P. Lewis. Brit. Pat. 213,295. *Chem. Age* **10**, 469.

CRACKING HYDROCARBON OILS.—A. McD. McAfee. U.S. Pat. 1,482,438. *Chem. Abstr.* **18**, 1049. *J. Soc. Chem. Ind.* **43**, B327.

PROCESS FOR TREATING HYDROCARBONS. S. L. Gartlan. Assr. to A. E. Gooderham. U.S. Pat. 1,484,612. *J. Soc. Chem. Ind.* **43**, B327 *Chem. Abstr.* **18**, 1194.

HYDROGENATING HYDROCARBONS. E. C. R. Marks. Brit. Pat. 210,131. *Oil Engineering and Finance* **5**, 278.

CRACKING HYDROCARBONS.—G. Gane. Brit. Pat. 206,121. *Chem Abstr.* **18**, 1193.

CRACKING HYDROCARBONS.—A. E. Alexander. Brit. Pat. 207,276. *Chem. Abstr.* **18**, 1194. *J. Soc. Chem. Ind.* **43**, B84.

DISTILLING AND CRACKING HYDROCARBON OILS.—F. Tinker. Brit. Pat. 205,289. *Chem. Abstr.* **18**, 1194.

CONVERTING HYDROCARBON OILS INTO PRODUCTS OF LOWER BOILING POINT.—V. L. Emerson. U.S. Pat. 1,484,014. *Chem. Abstr.* **18**, 1194. *J. Soc. Chem. Ind.* **43**, B410.

APPARATUS FOR CRACKING HYDROCARBONS AND RECOVERING GASOLINE.—M. H. Kotzebue and L. M. Bowman. U.S. Pat. 1,485,083. *J. Soc. Chem. Ind.* **43**, B366.

PURIFYING AND HYDROGENATING HEAVY MINERAL OILS, COAL DISTILLATES, COAL SLIMES OR OTHER HEAVY HYDROCARBONS.—Internationale Bergin Compagnie voor Olie en Kolen-Chemie and M. Hofsaas. Brit. Pat. 213,661. *Chem. Age* **10**, 495.

CRACKING OILS UNDER PRESSURE.—C. Ellis. U.S. Pat. 1,415,232.

CONVERSION OF HYDROCARBON OILS.—V. L. Emerson. U.S. Pat. 1,414,400.

CRACKING OILS.—R. D. George. U.S. Pat. 1,420,832.

PROCESS OF AND APPARATUS FOR CRACKING OILS.—G. L. Hoxie. U.S. Pat. 1,418,713.

APPARATUS FOR THE CRACKING OF HYDROCARBON OILS.—J. Nelson. U.S. Pat. 1,412,540.

16. INSULATING OILS.

ACTION OF METALS AND COMBINATIONS OF METALS ON TRANSFORMER OILS.—H. von der Heyden and K. Typke. Petroleum **20**, 320. *J. Soc. Chem. Ind.* **43**, B364.

17. Shale and Shale Oils.

Bituminous Shales of Madagascar.—J. A. Hardel. *Chem. and Ind.* **43**, 363.

New Shale Field in England to be Thoroughly Developed.—*Oil Tr. J.* **15**, (3), 30.

Oil-shales of Brazil.—D. T. Day. *Oil Engineering and Finance* **5**, 232.

Catlin Markets Shale Oil Fuel.—*Oil Engineering and Finance* **5**, 233.

Mineral Oil from Shale in Sweden.—*Oil Engineering and Finance* **5**, 233.

May Work Shale for By-products Only, Denver Operator Announces. —*Nat. Petr. News* **16**, (2), 28.

Would Utilise Deposits of Shale in Sweden.—*Nat. Petr. News* **16**, (2), 58.

Recovery of Ammonia from Oil Shale.—*University of Utah Bulletin* **14**. *Petr. Times* **11**, 535.

Oil in Newfoundland.—*Oil and Gas J.* **23**, (17), 66.

The Occurrences of Bituminous Shale in the Communes of Ronda, Alpandeire and Cortes de la Frontera, Malaga.—L. Souviron and M. Ranz-Aules. *Bol. ofic. minas met.* **5**, (65), 29. *Rev. Geol.* **4**, 793. *Chem. Abstr.* **18**, 804.

Oil Shale Bibliography, 1923.—V. C. Alderson. *Colo. School of Mines Quart.*, **19**, (1). *Railroad Red Book* **41**, 7. *Chem. Abstr.* **18**, 897. *Mining J.* **144**, 47, 74, 91.

Esthonian Oil-shale Industry.—*Petr. Times* **11**, 121. *Chem. Abstr.* **18**, 897.

Oil Shales of Somerset.—W. F. Leslie. *Petr. Times* **11**, 118, 730. *Chem. Abstr.* **18**, 897. *Chem. and Ind.* **43**, 532. *Oil News* **15**, 557.

Bituminous Shales of Cypris, Bohemia.—Prague Fuel Technology Report. *Oil News* **15**, 452. *Petr. World* **21**, 186.

National Importance of a British Oil Supply.—*Chem. Age* **10**, 438.

The Destructive Distillation of Oil Shale.—R. J. G. Stewart and J. Trenchard. *Quart. Colo. School Mines* **18**, (3), 6. *Chem. Abstr.* **18**, 1048.

Extraction of Oil from Shale.—G. W. Wallace. *Chem. Age* **9**, 625. *Chem. Abstr.* **18**, 1048.

Measuring Flow of Gases.—C. P. Turner and B. W. Winship. *Chem. and Met. Eng.* **30**, 177.

Oil-shale Developments in Sweden.—*Petr. Times* **11**, 618.

The Oil-shale Question.—E. F. English. *S. Afr. J. Ind.* **6**, 308. *Chem. Abstr.* **18**, 1193.

The San Romedio Mine of Bituminous Schists in the Trentino.—G. Castelli. *Rass. min. met. chim.* **59**, 113. *Chem. Abstr.* **18**, 1193.

FRACTIONAL "EDUCTION" OF OIL FROM OIL SHALE.—M. J. Gavin and L. C. Karrick. *U.S. Bur. Mines Repts. Investigations* 2588. *Petr. Times* **11**, 583. *Petr. World* **21**, 177.

THE TRUTH ABOUT TORBANITE.—*S. Afr. Min. and Eng. Jour.* **34**, 593.

ORANGE RIVER OIL SHALE.—*S. Afr. Min. and Eng. Jour.* **34**, 31.

THE RELATION OF PEAT TO OIL SHALE.—S. Linker. *Chem. Age* (New York) **32**, 63.

PATENTS.

PROCESS FOR TREATMENT OF OIL SHALE AND APPARATUS THEREFOR.—G. C. Hackstaff. U.S. Pat. 1,486,243. *Petr. Age* **13**, (8), 72. *Ref. and Nat. Gas Mfr.* **3**, (4), 37. *J. Soc. Chem. Ind.* **43**, B410.

LOW OR MEDIUM TEMPERATURE DISTILLATION OF OIL SHALE, BITUMINOUS COAL OR THE LIKE.—T. R. Starkey. Brit. Pat. 212,053. *Chem. Age* **10**, 362. *J. Soc. Chem. Ind.* **43**, B365.

APPARATUS FOR EXTRACTING VOLATILE MATTER FROM OIL-BEARING SHALE AND THE LIKE.—A. L. Mond. From the American Shale Reduction Co. Brit. Pat. 210,691. *J. Soc. Chem. Ind.* **43**, B245. *Oil Engineering and Finance* **5**, 691. *Chem. Age* **10**, 250.

RETORTS.—T. W. S. Hutchins. Brit. Pat. 208,357. *Oil Engineering and Finance* **5**, 229.

RETORT FOR DISTILLATION OF SHALE AND OTHER MATERIALS.—C. M. Garland. U.S. Pat. 1,473,616. *Nat. Petr. News* **16**, (2), 75. *Chem. Abstr.* **18**, 466. *J. Soc. Chem. Ind.* **43**, B8.

DESTRUCTIVE DISTILLATION OF SHALE AND THE LIKE TO OBTAIN OIL THEREFROM. S. G. S. Dicker. From S.E. Co. Brit. Pat. 211,033. *Chem. Age* **10**, 276. *J. Soc. Chem. Ind.* **43**, B286.

PREPARATION OF A HYDRAULIC CEMENT (FROM OIL SHALE).—Jura Oelschiefwerke A.-G. Ger. Pat. 376,606. *J. Soc. Chem. Ind.* **43**, B297.

PREPARATION OF CEMENT FROM OIL SHALE.—Plauson's Forschungsinst. G.m.b.H. Ger. Pat. 385,624. *J. Soc. Chem. Ind.* **43**, B297.

APPARATUS FOR FRACTIONAL DISTILLATION OF OILS FROM OIL SHALE OR SIMILAR MATERIAL.—D. K. Fairweather. From R. H. Crozier. Brit. Pat. 212,770. *Chem. Age* **10**, 416. *Petr. Times* **11**, 619. *J. Soc. Chem. Ind.* **43**, B410.

METHOD OF EXTRACTING TARS AND GASES FROM BITUMEN-CONTAINING MATERIALS.—M. Klötzer. Brit. Pat. 212,818. *Chem. Age* **10**, 416.

RETORT, HEARTH AND RABBLE APPARATUS FOR DISTILLING OIL FROM SHALE.—C. P. Bowie and M. J. Gavin. U.S. Pat. 1,480,045. *Chem. Abstr.* **18**, 900.

DESTRUCTIVELY DISTILLING PETROLEUM OR MINERAL OIL FROM OIL SHALES, BITUMINOUS COAL AND OTHER HYDROCARBONACEOUS MATERIAL.—A. Stalli. Brit. Pat. 213,046. *Chem. Age* **10**, 445.

APPARATUS FOR DISTILLING CARBONACEOUS MATERIAL.—W. P. Perry. Brit. Pat. 213,100. *Chem. Age* **10**, 446.

RETORT FOR DISTILLING OIL FROM SHALE.—C. J. Dunten. U.S. Pat. 1,482,677. *Ref. and Nat. Gas Mfr.* **3**, (3), 35. *Chem. Abstr.* **18**, 1049. *J. Soc. Chem. Ind.* **43**, B327.

PRODUCTION OF A BINDING AGENT RESEMBLING CEMENT FROM OIL-SHALE CLINKER.—Jura Oelschiefer-Werke A.-G. Ger. Pat. 376,074-5 and 376,077. *J. Soc. Chem. Ind.* **43**, B336.

PRODUCTION OF ARTIFICIAL STONE FROM OIL-SHALE CLINKER.—Jura Oelschieferwerke A.-G. Ger. Pat. 387,952. *J. Soc. Chem. Ind.* **43**, B336.

UTILISATION OF OIL SHALE.—F. Boyschlag and R. Gaussen. Ger. Pat. 388,662. *J. Soc. Chem. Ind.* **43**, B365.

GASIFICATION OF FUEL IN A RING GAS-PRODUCER WITH THE PRODUCTION OF GAS RICH IN TAR AND FREE FROM STEAM.—F. Jahns. Ger. Pat. 387,293. *J. Soc. Chem. Ind.* **43**, B365.

EXTRACTION OF OIL SHALE.—Holzverkohlungs-Ind. A.-G. Ger. Pat. 389,393. *J. Soc. Chem. Ind.* **43**, B410.

APPARATUS FOR TREATING OIL-BEARING SHALE.—G. A. Heimbucher. U.S. Pat. 1,421,228.

18. LIGNITES AND COALS AND THEIR PRODUCTS.

THE USE OF COLLOIDAL FUEL.—*Petr. Times* **11**, 494.

CAST-IRON RETORTS FOR LOW-TEMPERATURE CARBONISATION.—C. H. S. Tupholme. *Chem. and Met. Eng.* **30**, 471.

LOW TEMPERATURE COKING OF HUNGARIAN COAL.—E. Laszlo. *Brennstoff-Chem.* **5**, 69. *Soc. Chem. Ind.* **43**, B284.

SOLID CONSTITUENTS OF LOW-TEMPERATURE COAL TAR.—J. Marcusson and M. Picard. *Brennstoff-Chem.* **5**, 68. *J. Soc. Chem. Ind.* **43**, B287.

DIRECT UTILISATION OF LOW-TEMPERATURE TAR BY THERMAL TREATMENT.—F. Fischer, H. Schrader, and C. Zerbe. *Ges. Abk. Kennt. Kohle*, **6**, 145. *Chem. Zentr.*, **95**, I, 838. *J. Soc. Chem. Ind.*, **43**, B287.

LIGNITE CARBONISATION.—W. W. Odell. *U.S. Bur. Mines Repts. Investigations* 2569.

DEVELOPMENTS IN COAL CARBONISATION.—Caracristi. Power. *Petr. Times*, **11**, 531.

THE UTILISATION OF BITUMINOUS LIGNITES.—*Petr. Times*, **11**, 534. *Petr. Times* **11**, 534.

LOW-TEMPERATURE CARBONISATION.—C. H. S. Tupholme. *Chem. and Met. Eng.* **30**, 397.

THE COAL SITUATION OF JUGO-SLAVIA.—M. Dolch. *Z. angew. Chem.*, **36**, 558. *Chem. Abstr.* **18**, 804.

THE LIGNITE INDUSTRY.—E. Marcotte. *Rev. sci.*, **61**, 618. *Chem. Abstr.* **18**, 893.

GRADED TEMPERATURE ZONES IN COAL CARBONISATION.—C. H. S. Tupholme. *Chem. Met. Eng.* **30**, 54. *Chem. Abstr.* **18**, 893.

LOW-TEMPERATURE CARBONISATION AND THE NEED FOR A NATIONAL SCIENTIFIC POLICY.—D. Brownlee. *Chem. and Ind.* **42**, 2. *Chem. Abstr.* **18**, 893.

LOW-TEMPERATURE TAR FROM BITUMINOUS COAL.—J. J. Morgan. *Chem. and Ind.* **42**, 1178. *Chem. Abstr.*, **18**, 893.

BENZENOID LIGNITE TAR FROM GAS WORKS.—Prague Fuel Technology Report. *Oil News* **15**, 452.

LOW-TEMPERATURE CARBONISATION.—C. H. Lander and R. F. McKay. Ernest Benn, Ltd., London.

THE RHENISH LIGNITE INDUSTRY.—Frézouls. *Rev. ind. minerale*, 1923, 647. *Chem. Abstr.* **18**, 958.

LIGNITE COKE RICH IN VOLATILE COMBUSTIBLE (FLAME COKE).—A. Thau. *Braunkohle* **22**, 475.

LIGNITE COKE RICH IN VOLATILE COMBUSTIBLE.—F. Schneidenschnur, *Braunkohle* **22**, 476. *Chem. Abstr.* **18**, 1045.

LIGNITE COKE RICH IN VOLATILE COMBUSTIBLE.—O. Hubmann. *Braunkohle* **22**, 607. *Chem. Abstr.* **18**, 1045.

THE EFFECT OF GLOW (SILENT) DISCHARGE UPON TAR.—E. Eichwald. *Z. angew. Chem.* **38**, 611. *Chem. Abstr.* **18**, 1049.

DETERMINATION OF SULPHUR IN LIGNITE.—F. Bauridel. *Chem. Zeit.* **48**-122. *J. Soc. Chem. Ind.* **43**, B324.

LOW-TEMPERATURE CARBONISATION OF SOUTH AFRICAN COALS, AND EXTRACTION OF COAL BY SOLVENTS.—P. N. Lategan. *S. Afr. J. Ind.* **6**, 609; **7**, 41, 103. *J. Soc. Chem. Ind.*, **43**, B324.

LOW-TEMPERATURE CARBONISATION OF LIGNITIC BROWN COAL.—H. Trutnovsky. *Braunkohle* **21**, 509. *Chem. Zentr.* **95**, I, 985. *J. Soc. Chem. Ind.*, **43**, B325.

FIRST GENERAL REPORT OF THE LIGNITE UTILISATION BOARD OF CANADA, COVERING OPERATIONS OCTOBER 1, 1918 TO JANUARY 1, 1924.—The Lignite Utilisation Board of Canada, Montreal.

USING A MODIFIED MOND PRODUCER FOR LOW-TEMPERATURE CARBONISATION.—C. H. S. Tupholme. *Chem. Met. Eng.* **30**, 271. *Chem. Abstr.* **18**, 1189.

THE HISTORY OF THE SAXONY-THURINGIA BROWN-COAL TAR AND MONTAN WAX INDUSTRY.—W. Grosse. *Braunkohle* **22**, 625, 641, 666.

CARBONISATION OF BRIQUETTED LIGNITE.—A. Müller. *Gas. -u. Wasserfach* **67**, 137. *J. Soc. Chem. Ind.* **43**, B361.

COMPOSITION OF LOW-TEMPERATURE TAR. IV.—F. Schütz, W. Buschmann, and H. Wissenbach. *Ber.* **57**, 421. *J. Soc. Chem. Ind.* **43**, B377.

A COMPARATIVE STUDY OF SOME COAL TARS PRODUCED BY LOW-TEMPERATURE CARBONISATION.—K. B. Edwards. *J. Soc. Chem. Ind.* **43**, 143T, 149T.

TAR OILS FROM LOW-TEMPERATURE CARBONISATION OF SOUTH AFRICAN COALS.—P. N. Lategan. *S. Afr. J. Ind.* **7**, 152. *J. Soc. Chem. Ind.* **43**, B411.

La Distillation des Lignites.—F. Colomer. *Le Génie Civil* **83**, 181.

Liquid Fuels from Coal Result of Chemical Research.—*Gas Age Record* **52**, 307.

La Commission de Carbonisation et la Carbonisation (Obligatoire). *Le Génie Civil* **83**, 453.

Coal Carbonisation and Physical Laws Governing It.—A. W. Warner. *Gas Age Record* **52**, 517.

Patents.

Processes and Plants for the Low-temperature Carbonisation of Solid Fuels, Carbonaceous Material and the Like.—W. C. White. Brit. Pat. 192,040. *J. Soc. Chem. Ind.* **42**, B244.

Rabble for Low-temperature Coal Distillation.—E. Barrs. U.S. Pat. 1,482,342.

Distillation of Powdered Coal and other Carbonaceous Materials.—L. P. Webert. U.S. Pat. 1,481,399. *Chem. Abstr.* **18**, 1046.

Removing Resinous Constituents from and Purifying Montan Wax.—F. Nathanson. Ger. Pat. 386,632. *J. Soc. Chem. Ind.* **43**, B327.

Isolation of Montan Wax and Similar Bituminous Substances.—W. Gintl and K. Müller. Ger. Pat. 385,153. *J. Soc. Chem. Ind.* **43**, B366.

Production of Gas, Low.-temperature Tar, and Semi-coke.—J. Rude. Ger. Pat. 387,444. *J. Soc. Chem. Ind.* **43**, B365.

Low-temperature System for Carbonising Lignite.—E. Owen. U.S. Pat. 1,486,794. *Chem. and Met. Eng.* **30**, 757.

Continuous Treatment of Coal or Hydrocarbons by Hydrogenation or Distillation under Pressure.—Erdöl und Kohle-Verwertung A.-G. and A. Debo. Ger. Pat. 389,946. *J. Soc. Chem. Ind.* **43**, B410.

19. Pitch, Asphalt and Bitumen.

The Bituminous Sands of Northern Alberta. Their Separation and their Utilisation in Road Construction.—H. A. Clark. *Third Ann. Rept. Sci. Ind. Research Council of Alta*, 1922, **42**. *Chem. Abstr.* **18**, 891.

Consistency as Applied to Road Materials.—A. N. Johnson. *Proc. Am. Soc. Testing Materials* **23**, II., 456. *Chem. Abstr.* **18**, 1022.

Tests and Specifications for Road Oil.—R. T. Baker. *Oil and Gas J.* **23** (11), 36. *Chem. Abstr.* **18**, 1047.

Tests of the Elastic Properties of Low-temperature Tar Residues.—J. Marcusson and H. Burchartz. *Mitt. Materialprufungsamt* **40**, 88. *Chem. Abstr.* **18**, 1190.

Asphalt-bearing Rocks as a Source of Mineral Oils and of Lubricants.—C. Manuelli. *Indust. olii e grassi* **3**, 18. *Chim. et Ind.* **11**, 80. *Chem. Abstr.* **18**, 1193.

THE JELLYING OF ASPHALT PAINTS.—H. C. Fisher. *Ind. and Eng. Chem.* **18**, 509.

USE OF ASPHALTIC CONCRETE IN PAVEMENTS.—C. P. Johnson. Asphalt Association. *Canadian Eng.* **45**, 620.

ASPHALTIC CONCRETE PAVEMENTS.—J. Adler, International Road Congress. *Canad. Eng.* **45**, 390.

SURFACE TREATING AND LIQUID ASPHALTS.—C. M. Baskin. *Canad. Eng.* **45**, 167.

CLINKER ASPHALT ROADS.—*Canad. Eng.* **45**, 191.

ASPHALTIC SURFACE TREATMENT OF GRAVEL ROADS.—G. C. Dillman. International Road Congress. *Canad. Eng.* **45**, 412.

ASPHALT SIMPLIFICATIONS EFFECTIVE JANUARY 1.—*Good Roads* **65**, 132.

CAUSES OF WAVES IN ASPHALT PAVEMENTS.—P. Hubbard. *Canad. Eng.* **45**, 393.

THE USE OF ASPHALT CONCRETE IN PAVEMENT BASES.—C. P. Jonson. *Good Roads* **65**, 190, 202.

PAVING COTE SAINT CATHARINE ROAD, OUTREMONT.—I. H. Parker. *Canad. Eng.* **45**, 192.

CONSTRUCTION OF ASPHALTIC MACADAM PAVEMENTS.—I. W. Patterson. International Road Congress. *Canad. Eng.* **45**, 452.

THE USES OF ASPHALT IN HIGHWAY CONSTRUCTION.—I. W. Patterson. *Good Roads* **65**, 73. *Canad. Eng.* **45**, 109.

GETTING THE MOST FOR THE HIGHWAY DOLLAR.—J. E. Pennybacker. *Good Roads* **65**, 188.

PATENTS.

ASPHALT ROOFING.—F. C. Overbury. U.S. Pat. 1,481,430. *Chem. Abstr.* **18**, 892.

PRODUCTION OF COLLOIDAL DISPERSIONS OF ASPHALT OR PITCH.—Plauson's Forschungsinstitut G.m.b.H. Ger. Pat. 385,860. *J. Soc. Chem. Ind.* **43**, B327.

BITUMINOUS COMPOSITIONS.—T. Murphy. Brit. Pat. 206,888. *Chem. Abstr.* **18**, 1187.

MANUFACTURE OF COLOURED ASPHALT. MANUFACTURE OF ASPHALT.—Building Accessories and Flooring Co. Ltd. H. Goodwin and H. Smith. Brit. Pat. 212,106 and 212,188. *J. Soc. Chem. Ind.* **43**, B384.

20. PARAFFIN, OZOKERITE, VASELINE.

MINERAL WAX PRODUCTION IN POLAND.—*J. Royal Society Arts* **71**, 671.

21. Origin of Petroleum.

Why is Oxygen absent from Petroleum?—H. Hixon. *Eng. and Min. J. Press. Petr. Times* **11**, 510.

The Probable Origin of Light Oils in the Rocky Mountain Region.—W. H. Geis. *Bull. of the Amer. Assoc. Petr. Geol.* (Sept.-Oct.). *Nat. Petr. News* **16**, (5), 71. *Chem. Abstr.* **18**, 958.

Petroleum from Fish.—*Petr. Times* **11**, 601.

Petroleum Deposits of Czechoslovakia.—J. J. Jahn. *Petroleum* **19**, 1165. *Chem. Abstr.* **18**, 958.

Some New Light on the Origin of Petroleum.—A. Wade. *Oil News* **15**, 555.

Upholds the Vegetable Origin of Oil.—E. H. C. Craig. *Oil and Gas J.* **22**, (24), 62.

Les Pétroles des Silaciens.—*La Nature*, 1923, 141.

22. Physical Properties of Petroleum and its Products.

Physical Properties of the Paraffin Hydrocarbons.—R. E. Wilson and W. H. Bahlke. *Ind. Eng. Chem.* **16**, 115. *J. Soc. Chem. Ind.* **43**, B243. *Chem. Abstr.* **18**, 748.

Interfacial Tension between Petroleum Products and Water.—E. M. Johansen. *Ind. and Eng. Chem.* **16**, 132. *J. Soc. Chem. Ind.* **43**, B243. *Chem. Abstr.* **18**, 748.

The Mechanism of Lubrication. III.—The Effect of Oiliness on the Behaviour of Journal Bearings.—D. P. Barnard, H. M. Myers, and H. O. Forrest. *Ind. and Eng. Chem.* **16**, 347.

Surface Films as Plastic Solids.—R. E. Wilson and E. D. Ries. *Colloid Symposium Monograph* (*Univ. of Wisconsin*), 1923, **145**. *Chem. Abstr.* **18**, 924.

Fluidity Anomalies in Refined Mineral Oils.—E. C. Bingham, W. L. Hyden, and G. R. Hood. *Ind. and Eng. Chem.* **16**, 25. *Chem. Abstr.* **18**, 1048. *J. Soc. Chem. Ind.* **43**, B162.

Viscosity of Lubricants at High Pressure and Temperature.—M. D. Hersey. *J. Soc. Auto. Eng.* **14**, 188. *Chem. Abstr.* **18**, 1049.

Dependence of Viscosity upon Temperature.—F. König. *Z. angew. Chem.* **37**, 8. *Chem. Abstr.* **18**, 1074.

Mechanical Properties of Fluids.—C. V. Drysdale, A. Ferguson, A. E. M. Geddes, A. H. R. Gibson, F. R. W. Hunt, H. Lamb, A. G. M. Mitchell, G. I. Taylor, and Sir George Taylor. D. Van Nostrand and Co., New York.

23. Chemistry of Petroleum.

Chemical Nature of the Naphthenic Acids.—I. N. Zelinsky. *Ber.* **57**, 42. *J. Soc. Chem. Ind.* **43**, B243.

Chemical Nature of the Naphthenic Acids. II.—N. Zelinsky and E. Pokrowskaja. *Ber.* **57**, 51. *J. Soc. Chem. Ind.* **43**, B243.

NAPHTHENIC ACIDS. IV.—METALLIC SALTS OF NAPHTHENIC ACIDS.—Y. Tahaka, K. Horiuchi, and G. Oyama. *Kôgyô-Kwagaku Zasshi* (*J. Chem. Ind. Japan*) **26**, 1190. *J. Soc. Chem. Ind.* **43**, B243.

THE COMBUSTION OF OIL.—J. E. Hackford. *Oil Engineering and Finance* **5**. 235.

VANADIUM IN PETROLEUM.—G. S. Porter. *Min. and Metallurgy* (March), *Petr. Times* **11**, 529.

ACTION OF IODINE ON HYDROCARBONS.—F. J. Nellensteyn. *Chem. Weekblad* **21**, 102. *J. Soc. Chem. Ind.* **43**, B285.

VELOCITY OF OXIDATION OF PARAFFIN WAX. I.—IV.—F. Francis, W. F. Millard, C. H. Rutt, C. M. Watkins, R. W. Wallington, and C. P. Garner. *J. Chem. Soc.* **125**, 381.

THE OXIDATION OF HYDROCARBONS WITH SPECIAL REFERENCE TO THE PRODUCTION OF FORMALDEHYDE. IV.—SOME FURTHER EXPERIMENTS ON THE ACTION OF OXYGEN ON ETHYLENE.—E. W. Blair and T. S. Wheeler. *J. Soc. Chem. Ind.* **42**, 415T. *Chem. Abstr.* **18**, 814.

THE ACTION OF OZONE ON HYDROCARBONS WITH SPECIAL REFERENCE TO THE PRODUCTION OF FORMALDEHYDE. THE ACTION OF OZONE ON ETHYLENE.—E. W. Blair and T. S. Wheeler. *J. Soc. Chem. Ind.* **42**, 343T. *Chem. Abstr.* **18**, 814.

CONTRIBUTION TO THE STUDY OF THE CHLORINATION OF METHANE. PART V.—H. Gault. *Les Matières Grasses* **17**, 6722.

PARTIAL COMBUSTION OF METHANE.—E. Berl and H. Fischer. *Z. ange. Chem.* **36**, 297. *Chem. Abstr.* **18**, 968.

COMPOSITION OF NATURAL-GAS GASOLINE.—R. P. Anderson and A. M. Erskine. *Ind. Eng. Chem.* **16**, 263. *Chem. Abstr.* **18**, 1048. *J. Soc. Chem. Ind.* **43**, B363.

THE OXIDATION OF SATURATED HYDROCARBONS BY OZONE.—R. Koetschau and W. Fleming. *Z. angew. Chem.* **37**, 42. *Chem. Abstr.* **18**, 1124.

THE CHEMICAL NATURE OF NAPHTHENIC ACIDS.—O. Aschan. *Ber.* **57**, 636.

SULPHUR IN CRUDE PETROLEUM.—N. A. C. Smith and D. D. Stark. *U.S. Bur. Mines Reports Investigations* 2582. *Petr. Times* **11**, 653, 724.

COMPOSITION OF JAPANESE PETROLEUM.—I. S. Komatsu and S. Kusumoto. *Mem. Coll. Sci. Kyoto* **7**, 77. *J. Soc. Chem. Ind.* **43**, B408.

PATENTS.

HYDROCARBONS, ETC., MOTOR SPIRIT, SOAPS.—C. P. Byrnes. Brit. Pat. 209,128. *Oil Engineering and Finance* **5**, 230.

SULPHO COMPOUNDS FROM MINERAL OIL PRODUCTS.—E. M. Johansen. U.S. Pat. 1,477,829. *Chem. Abstr.* **18**, 899. *J. Soc. Chem. Ind.* **43**, B124.

UNSATURATED PRODUCTS FROM CHLORINATED HYDROCARBONS.—H. A. Gardner. U.S. Pat. 1,484,018. *Chem. Abstr.* **18**, 1194.

TREATING OLEFINIC HYDROCARBONS.—A. S. Ramage. U.S. Pat. 1,483,835. *Chem. Abstr.* **18**, 1194.

PRODUCTION OF ARTIFICIAL RESINS AND WAXES.—Erdöl und Kohle-Verwertung A.-G., and F. Zernik. Ger. Pat. 388,289. *J. Soc. Chem. Ind.* **43**, B392.

HALOGENATION OF HYDROCARBONS AND THEIR DERIVATIVES.—H. T. Tizard. Brit. Pat. 214,293. *Chem. Age* **10**, 545.

PREPARING CHEMICAL PRODUCTS FROM OLEFINES AND OLEFINE-CONTAINING MIXTURES.—A. S. Ramage, Assr. to Bostaph Engineering Corp. U.S. Pat. 1,483,835. *J. Soc. Chem. Ind.* **43**, B410.

PREPARATION OF ALKALI SALTS OF NAPHTHASULPHONIC ACIDS.—Oelwerke Stern-Sonneborn-A.G. Ger. Pat. 385,222. *J. Soc. Chem. Ind.* **43**, B411.

24. OIL AND PETROL GAS.

USING HEAVY OIL IN GAS-MAKING.—O. B. Evans and H. G. Terzian. U.S. Pat. 1,418,782.

PATENT.

CARBURETTING.—Humphreys and Glasgow, Ltd. Brit. Pat. 200,604. *Chem. Abstr.* **18**, 1046.

25. MISCELLANEOUS.

RELATION OF PURCHASING AND TRAFFIC DEPARTMENTS.—G. C. Pohler. *Oil Tr. J.* **15**, (3), 36.

THE QUALITY OF CRUDE PETROLEUMS.—*Petr. Times* **11**, 518.

TERENY I ZLOZA NAFTOWE.—J. Bohdanowicz, Warsaw. *Nat. Petr. News* **16**, (5), 32–E.

COST-ACCOUNTING METHODS FOR THE USE OF THE REFINER.—R. W. McKee. *Nat. Petr. News* **16**, (5), 37.

OILDOM, ITS TREASURES AND TRAGEDIES.—O. H. Reinholt. Gulf Publishing Co., Houston, Texas.

LEASE FORMS AND LEASING DIFFICULTIES.—R. Greenslade. *Oil and Gas J.* **23**, (17), 28.

OLII E GRASSI; VEGETALI, ANIMALI E MINERALI.—G. Fahis. Ulrico Hoepli, Milan.

VALUATION OF OIL AND GAS LANDS.—R. W. Brown. McGraw-Hill Publishing Co., Ltd.

OIL AND GAS CODE.—Business Code Company, New York.

THE NECESSITY FOR PETROLEUM RESEARCH.—G. O. Smith. *Petr. Times* **11**, 657.

PETROLEUM AS A RAW MATERIAL IN THE CHEMICAL INDUSTRY.—B. T. Brooks. *Ind. and Eng. Chem.* **16**, 185. *Petr. Times* **11**, 694.

VITAL NEED OF OIL CONSERVATION.—E. W. Marland. *Min. and Oil Bull.* **9**, 962.

GOVERNMENTAL INVESTIGATION OF POLLUTION OF NAVIGABLE WATERS.—*Chem. Age* (New York) **31**, 433.

A CALL TO THE CHEMIST TO PURGE INDUSTRY OF ITS CONTAMINATION OF OUR COAST AND INLAND WATERS.—D. M. Neuberger. *Chem. Age* (New York) **31**, 431.

THE STORY OF THE PACIFIC OIL COMPANY.—*Min. and Oil Bull.* **9**, 958.

CONSERVATION OF THE FUEL SUPPLIES OF THE PACIFIC COAST.—F. H. Sibley. *Mech. Eng.* **44**, 659.

THE WORLD'S OIL SUPPLIES.—*S. Afr. Min. and Eng. J.* **34**, 230.

ABSTRACTS.

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GENERAL.

WORLD PRODUCTION OF OIL SHOWS GENERAL INCREASE.—*Chem. Met. Eng.*, 1924, **30**, 473.

Figures for production from all countries are given for 1923 by the American Petroleum Institute, and for 1922 by the U.S. Geological Survey. The world's production for 1923 is estimated at 1,010,995,000 barrels, an increase of 18·3 per cent. over 1922, of which the United States produced 72·7 per cent. or 735,000,000 barrels, an increase of 31·8 per cent. over the preceding year. The United States and Mexico combined produced 87·5 per cent. of the world's output in 1923 and 86·5 per cent. in 1922, Russia 3·8 per cent., Persia 2·5 per cent., Dutch East Indies 1·5 per cent., Roumania 1·1 and India 0·7 per cent. Poland 0·5 per cent. No other country reached 0·5 per cent. F. G. P. R.

COMPOSITION OF NATURAL GAS GASOLINE.—R. P. Anderson and A. M. Erskine. *Ind. Eng. Chem.*, 1924, **16**, 262–267.

Although considerable work has been done on the isolation of those hydrocarbons constituting the lower boiling distillates of petroleum, the exact nature of the components present in casing head gasoline has not been determined.

The authors, however, by means of a long series of careful fractionations have been able to isolate those constituents and give a close approximation of the actual composition of this class of spirit.

Starting with a sample of 3000 c.c., sp. gr. 0·6667, at 15·5–15·5° C. five preliminary fractionations were made which gave four fractions each with a boiling range of 20° C. and in the region of pentane, hexane, heptane and octane respectively. Various types of columns were employed with increasing efficiency as the cuts became closer and used in conjunction with regulated temperature still heads.

The pentane fraction obtained from the preliminary fractionation was re-run three times giving isopentane (2-methyl butane) B.P. 27·8° to 28·3° C. and *n*-pentane 35·5° to 36°.

The hexane fraction after four runs gave isohexane (2-methyl pentane) 60° to 61° C., and *n*-hexane 68° to 69° C.; and the heptane fraction after twelve runs gave isoheptane (2-methyl hexane) 90° to 91° C. and *n*-heptane 98° to 99° C.

The approximate composition of the gasoline was thus shown to be :—

Propane and Butane	20	per cent.	(by vol.).
Isopentane	13	„	
n-Pentane	17	„	
iso-hexane	9	„	
n-hexane	15	„	
iso-heptane	8	„	
n-heptane	12	„	
octane	4	„	
absorption oil	2	„	—100 per cent.

Distillation and Specific Gravity/Boiling Point curves are given for all fractions and show the presence of small quantities of aromatic hydrocarbons in the higher fractions. S. B.

THE TESTING OF PETROLEUM OILS FOR GASIFICATION.—A. Holmes. *Ind. Eng. Chem.*, 1924, **16**, 258–261.

The following investigation was carried out to establish the possibility of determining the value of an oil for gas manufacture. As the quality of an oil for this purpose depends on the amount of paraffin and naphthene hydrocarbons present, aromatics and olefinic bodies being detrimental, the method of estimating the latter was considered in detail.

The formolite value, which consists in the condensation of aromatic bodies with formaldehyde in the presence of sulphuric acid, was tried, as were also the various modifications of this test, including the use of trioxy methylene suggested by Tausz. The most consistent results were obtained using the method as originally applied by Nastjukoff and using the proportions 1 : 1 : 1·5 for oil, sulphuric acid and formaldehyde respectively.

The absorption in sulphuric acid was also tried, using acid from 98 per cent. strength up to 30 per cent. oleum. The treatment was carried out in Babcock bottles with vigorous shaking, followed by centrifuging and over-night settlement.

In these tests it was observed that the aromatics reacted much more readily with the acid than the unsaturated bodies, which required treatment with oleum to ensure complete removal.

The results of these tests, together with the average boiling point, gravity and iodine values of various oils, show that an accurate gasification value of an oil can be obtained and a formula is given for such evaluation. Complete details of experimental data and tables of results are given. S. B.

DETERMINATION OF THE UNSATURATED AND AROMATIC CONSTITUENTS OF LOW TEMPERATURE TAR. H. Arnold. *Z. angew. Chem.*, 1923, **36**, 545.

The tar oils and benzines (cf. C.A. **17**, 3414) were examined by means of the $Hg(OAc)_2$, $(CH_2)_2SO_4$ and formolite reactions and the composition given in terms of paraffins, olefines, aromatics, unsaturated aromatic compounds and naphthenes of the benzine separated by activated charcoal, the wash oil benzine, the tar benzine and tar oil fractions. The unsaturated portions of the oil contained more sulphur than the saturated. The iodine value is of little use in determining composition on account of the complex nature of low-temperature tar oils. F. G. P. R.

FLOATING ROOFS FOR OIL TANKS. L. Schmidt. *U.S. Bureau of Mines Bulletin. Petroleum World*, 1924, **21**, 74–80.

The report deals with floating roofs equipped with movable buffers or shoes kept in contact with the inner walls of the tank by means of springs. Constructional drawings and dimensions are given in considerable detail, which are impossible to reproduce in abstract form. The roof, however, consists essentially of a tub floating on the surface of the oil, the intervening space between the walls of the tub and those of the tank being filled by movable shoes or buffers, which form a more or less vapour-tight joint with the tank walls. In some stages of handling petroleum 80 per cent. of the total losses are due to the expulsion of vapour saturated air when filling tanks, whilst the cause next in order of magnitude is that due to breathing brought about by variations in atmospheric conditions. Probably the most effective method of preventing both these losses is by reducing the vapour space over the surface of the oil. When the shoe passes over rivet heads on the walls of the tank a space of about ¼-in. is exposed to the atmosphere, which on a 30 foot diameter tank amounts to a total of about two square feet of surface. Evaporation losses from this area—calculated from actual losses experienced with an open tank of crude oil during five days—amounted to 4·5 gallons in five days. Laboratory tests of losses per year of gasoline from different widths of exposed surface between the shoe and the wall of a 117 foot diameter tank were ⅛-in.—9·1 gallons, ¼-in.—57·3 gallons, ½-in.—145·1 gallons and 1½-in.—1530 gallons. These results can, however, only be regarded as comparative and not as great as would occur in practice. To compare the losses from an ordinary tight tank and one fitted with a floating roof two 1250 barrel tanks were connected by a pipe at one foot above the bottom. One tank (*A*) was filled and the other (*B*) contained 1 foot of gasoline. The spirit was pumped from A to B, allowed to stand over night and then pumped back to B, and the losses measured when the tanks were fitted with an ordinary tight canopy roof and a floating roof. The average temperature of the gasoline in the former case was 56·6° F. and in the latter 54·9° F., and the losses in volume per cent. were 0·17 and 0·04. Tests were next made of the fire resisting qualities of floating roofs. The exposed vapour between the shoe and the tank wall was fired, but merely flashed round the roof and went out. Five gallons of gasoline were poured on the roof and fired, and after this had burned itself out the gasoline round the shoes was found to be alight in several places, but these were easily extinguished by cooling the hot metal with a hand fire extinguisher.

F. G. P. R.

TESTING DECOLORISING CARBONS.—J. E. Teeple and P. Mahler. *J. Ind. Eng. Chem.*, 1924, **16**, 498.

Most recent works tend to show that all adsorption by decolorising carbon follows Freundlich's adsorption equation $\frac{x}{m} = KC\frac{i}{n}$ within experimental error. The Hess-Ives photometer gives satisfactory results since it measures a definite amount of colouring matter in the path of the beam of light and is practically independent of dilution. The colour unit is that amount which absorbs 1 per cent., or transmits 99 per cent., of the incident light. By inserting different colour screens different readings of the amount of colour are obtained, and there is no means of comparing one with another. Most liquids or oils to be decolorised are coloured red, yellow, brown or some combination of colours in the lower part of the spectrum. They show most absorption

of blue-violet light, and hence it is advisable to work solely with the blue violet screen, and in terms of blue-violet colour units. Freundlich's equation states that the amount of colour adsorbed by one gram of carbon (x colour units divided by m grams of carbon) equals the product of the final concentration of colour left in solution (C colour units) raised to a certain power ($1/n$) multipled by another constant K. In logarithmic form $\log x/m = \log K + 1/n \log C$ represents a straight line when $1/n$ represents the slope of the line, log K the intercept on the y axis and K the number of colour units each gram of carbon would hold if the final concentration of colour were reduced to one colour unit. Knowing these two constants for any carbon acting on a certain solution a direct comparison can be made between them for that particular solution. Each solution, however, requires a separate set of curves to be made, and therefore the general evaluation of carbons by the iodine adsorption or any other standard method is futile. It was also found that a carbon that gives the best result at one final concentration of colour left in a solution will not necessarily be the best at another concentration. The curves therefore for a number of carbons shows which is the best for the particular work required, irrespective of their order of merit at maximum adsorption. In making the curves on cotton seed oil a peculiar result was obtained showing the carbon in equilibrium over a range of colour units adsorbed—which is impossible—and pointing to some change in acidity or alkalinity during the experiment. Two series, definitely acid and alkaline, were then run and both curves showed a sharp break indicating that some colour—probably red—was adsorbed rapidly at the start, and that later another colour—probably yellow—was adsorbed much more slowly. The acid medium was also found more effective than the alkaline, contrary to Chaney's statement that "the colour particles in cotton seed oil are positively charged and acidification decreases the decolourising power of the carbon." Other things besides colour are adsorbed by carbon and these may influence the adsorption. Thus if a solution of molasses is treated in stages with different portions of carbon, a superior result is obtained in the final product, than by a single treatment with the whole of the carbon. Probably the removal of the inhibiting material occurs in the first treatment and thus allows more colour to be removed by subsequent treatments. Dilution also acts in the same way and increases the amount of colour adsorbable by a given weight of carbon. F. G. P. R

ADSORPTIVE CAPACITY OF WOOD CHARCOAL FOR DISSOLVED SUBSTANCES IN RELATION TO THE TEMPERATURE OF CARBONISATION.—J. C. Phillip and J. Jarman. *J. Phys. Chem.*, 1924, **28**, 346.

In the preparation of adsorptive charcoal the present evidence is conflicting on such points as: (1) the optimum temperature conditions, and (2) whether, of a number of charcoals, the one which is found to have the highest adsorptive activity in regard to a particular adsorbed substance is necessarily also the most active in relation to other substances. Small cubes of birchwood were kept at definite temperatures ranging from 350° C. to 850° C. for known periods and with varying quantities of admitted air. Carbon, hydrogen and ash determinations were made of each and the adsorptive capacity tried on solutions of iodine, oxalic acid, methylene blue, tartar emetic and quinine sulphate. As a result of estimations with twenty-five samples of birch charcoal prepared under different conditions by carbonisation alone it appeared that the optimum temperature varied with the nature of the substance to be adsorbed, but

that increased access of air during carbonisation at the higher temperature resulted in a marked increase of activity. By carefully duplicating the conditions of preparation it was found possible to obtain charcoals that gave the same degree of activity. In the tests with tartar emetic and quinine sulphate there was a steady improvement in adsorptive capacity with rise in temperature of carbonisation. With methylene blue all charcoals prepared below 650° C. were approximately equal, but above that there was a marked rise with temperature. On the other hand with iodine and oxalic acid there was a general rise in activity to 650° C., but above that a definite falling off. Prolongation of carbonisation at a given temperature did not appear to produce much effect.

F. G. P. R.

Apparatus for the Measurement of Temperatures in Deep Wells by Means of Maximum Thermometers.—C. E. van Orstrand. *Econ. Geol.*, 1924, **19**, 229.

The apparatus has been designed in response to the increasing demand for data of deep earth temperatures, investigated first in 1664 and unsystematically ever since. Electrical methods have proved unsatisfactory, and maximum thermometers give best results. Special thermometers are used. The varying conditions of field-observation have to influence the design of the apparatus for lowering and raising them in the well. It consists essentially of a hand-operated drum carrying about 9000 ft. of No. 20 B. & S. polished steel piano wire, fitted with distributing mechanism, measuring wheel and brake. To the end of the wire is attached a container in which a holder fitted with a set of three maximum thermometers is fixed. The containers are of various forms to suit different conditions. When small depths in dry holes are being explored, the sand-line of the ordinary drilling plant is sometimes employed, the line being run over a special depth recorder.

Experience is required to obtain good results. When surface temperatures are higher than those in the well special precautions have to be taken, such as reading the thermometers at dawn, or covering the well with an ice-cloth and receiving the instruments in an ice-bath. The hole is usually explored to its greatest depth first to ascertain approximately what conditions have to be provided for. The remaining determinations are made at intervals from above downwards. It is essential to determine the level of oil or water, as the thermometer would be spoilt or broken under the pressure from a column of fluid unless protected by a container. Several sets of thermometers can be attached to the line simultaneously. The mouth of the well should be covered to guard against anything falling. Unless the lowering wire is oiled with kerosene it tends to stick to the casing. Steel containers need not be more than 1/16th in. thick for depths of less than 3000 ft., and are advantageously made of non-corrosive nickel steel. The thermometers should not be lowered at over 200 ft. a minute or raised at over 100 ft. An exposure of 45 minutes has been found sufficient for steel containers in fluid, and one of about 1¼ hours for brass containers in air, but these times vary with conditions. Care must be taken not to jerk the lines. The best records are taken just before drilling into the pay sand, and drilling should have been discontinued at least twenty-four hours before the test. The error of observation should not exceed half a degree Fahrenheit. To test a 3000-ft. well takes at most two days, and, with readings at every 250 ft. may be done in eight hours. Using the sand-line and a depth recorder gives the correct depth within the required limits of error.

W. G. W.

RESEARCHES ON THE ADDITION OF WATER TO ETHYLENE AND PROPYLENE.—J. P. Wibaut and J. J. Diekmann. *Proceedings Koninklijke Akademie van Wetenschappen, Amsterdam.* XXVI., 321–328.

On account of their experimental work the authors find it probable that the addition of water to propylene and ethylene can take place under high pressure at temperatures far below 300°. Further, they investigated by one operation the hydration of ethylene and propylene by means of acids. Ethylene was led through heated, diluted sulphuric acid. By the addition of water vapour to the ethylene the concentration of the acid was kept constant. At the top of the apparatus used there escaped the not absorbed ethylene, water and alcohol. At 150°–160° with 65 per cent. sulphuric acid the conversion into æthylalcohol was 2–4 per cent. The experiments with propylene were arranged in the same way. With 45 per cent. sulphuric acid and at 125°–130° they obtained a yield of 10 per cent. of isopropyl alcohol. Besides part of the propylene was carbonised. With sulphuric acid of higher concentration (f.i. 96 per cent.) at low temperature the propylene is quickly attacked, but chiefly condensation products are formed. H. I. W.

COKE.—G. A. Brender à Brandis. *Het Gas*, **44**, 5 (1924).

A critical review regarding the requirements of blast-furnace coke and of foundry-coke. The researches made in Koppers Company laboratory, Pittsburgh, are compared with the results obtained by Sutcliffe and Evans (*Journ. Soc. Chem. Ind.*, 1922, xli., 196T), Bunte and Kölmel (*Gas und Wasserfach*, 1922, **65**, 592) and those of Franz Fischer (*Brennstoffchemie*, 1923, **4**, 33). H. I. W.

ACTION OF IODINE ON HYDROCARBON.—F. J. Nellenstevn, *Chemisch Weekblad*, 1924, **21**, 102.

In connection with the investigations of the author on the constitution and formation of asphalt (compare F. J. Nellensteyn, Dissertation, Technical University, Delft) investigations were carried out on the action of iodine on hydrocarbons. Generally spoken this action is strong and there is formation of HJ and "carbon" of high adsorbing properties. This reaction scheme is quite analogous with the asphalt formation by oxidation of hydrocarbons. Determinations of bromine numbers by the method of McIlhiney frequently instead of addition and substitution indicate adsorption and deshydrogenation.

H. I. W.

THE COMPOSITION OF JAPANESE PETROLEUM.—Shigeru Komatsu & Naozo Tanaka. *Memoirs of the College of Science*, Kyoto University. Vol. VII., No. 3, 1924.

The main portion of the 70°–90° fraction of Nishiyama oil consists of cyclohexane. The fraction 80°–82° of the Amaze oil, Echigo, yields by nitration 22 per cent. of dinitrobenzene. The fraction 70°–90° of the Nishiyama oil was treated with fuming sulphuric acid, the acidic solution diluted with ice, neutralised with calcium hydroxide, the calcium filtered off, and excess of lime removed with carbon dioxide. By treating the filtrate with sodium carbonate the calcium benzene sulphonate formed was converted into the sodium salt and the solution evaporated to dryness; 12 g. of the resultant sodium salt were fused with 21 g. of caustic soda, and the oily substance generated dried and fractionated twice. The second fraction, 182°–183° crystallised in fine needles, showed violet colour reaction with ferric chloride and Liebermann's reaction for nitroso compounds. By ultimate analysis it gave C=73·55 per cent. and H=6·45 per cent. Treated with benzoyl chloride, a benzoic acid ester was formed, melting at 69°–69·5°, with an ultimate

composition C=78·95 per cent. and H=5·22 per cent. The fraction 66·5°–71°, of sp. gr. 0·6938 of the Nishiyama oil, was oxidised with concentrated nitric acid, the product washed with dilute alkali, dried, and fractionated over metallic sodium. The fraction 67·5°–68·5° gave on analysis C=83·05 per cent., H=15·93, sp. gr. 0·66863. This fraction being re-mixed with the fractions 66·5°–67·5° and 68·5°–69·5° and the mixture again fractionated, the fraction 71°–73° gave on analysis C=83·80 per cent., H=15·80 per cent., sp. gr. 0·67178, indicating the presence of *n*-hexane. H. M.

ARGENTINE OIL INDUSTRY IN 1923.—Campbell M. Hunter. *The Times, Trade & Engineering Supplement*, March 29, 1923.

The oil industry in Argentina continues to increase, and the total production of 530,000 tons of crude oil in 1923 shows an increase of about 80,000 tons over 1922. This increase was chiefly derived from the Government properties at Comodoro Rivadavia and Plaza Huincul, although the Astra Petroleum Company and the Cia Ferrocarrilera de Petroleo also obtained a larger output :—

	Government production. Tons.	Private Companies production. Tons.	Total. Tons.
1920 ..	226,545 ..	31,964 ..	258,509
1921 ..	277,725 ..	44,330 ..	322,055
1922 ..	348,936 ..	101,264 ..	450,200
1923 ..	415,557 ..	114,500 ..	530,057

Changes in the management of the Government properties at Comodoro Rivadavia resulted in intensive development work, especially as regards extending proved areas. Owing to the lack of storage and transport, production on this property had to be restricted until the arrival of the two tankers ordered in 1922, and subsequently it became necessary to order another tanker, the arrival of which will bring the total carrying capacity of the Government tanker fleet to 37,000 tons.

The percentage of unproductive wells drilled continued to be small, amounting to under 5 per cent.

The Astra Petroleum Company completed ten productive wells during the year, its daily production now being about 250 tons. This Company is constructing a shipping port at Caleta Cordoba, about nine miles north of the Government pier at Comodoro Rivadavia, and tankers will be loaded by means of a submarine pipe-line ending at a dolphin.

The Cia Ferrocarrilera de Petroleo carried out prospecting work on its property during the year, and what promises to be a very productive section was located. A rich gas area was also developed, supplying fuel for use on the property and a surplus for neighbouring concerns.

Drilling by the Eastern Petroleum and Finance Company resulted in the locating of the northern extension of the Astra Company's prolific field, but so far oil has not been struck in commercial quantities.

By the end of the year the Anglo-Persian Oil Company had drilled some twelve wells, being most successful in the Cañadon Rosales area.

The operations of the various concerns indicate that productive wells can reliably be drilled over an area of at least ten miles in a north-south direction, with an at present unknown extension inland from the coast. In the Comodoro Rivadavia district the possibly productive area is considerable, the distance between the most northerly and the most southerly producing wells being about twenty miles.

Next to Comodoro Rivadavia the most important area is at Plaza Huincul, Territory of Neuquen, where a high-grade oil was struck by

the Government at the end of 1918. The Government intend to drill at least eighteen wells here during the present year, and to obtain authority to erect a refinery and increase the present storage facilities. Prospecting rights in this area have also been granted to several companies, and the Cia Petroleo de Challaco and the Argentine Oilfields, Limited, have been successful in sinking producing wells. So far the other companies operating here have not met with much success, though some of the wells have struck gas under considerable pressure.

In the Province of Jujuy a well sunk by the State Railways obtained oil at a depth of 538 metres.

The oil industry of Argentina has made considerable progress since its commencement, and the production in 1923 was about one-third that of Rumania and exceeded that of Trinidad, both of which countries have produced oil for many years.

The proposed alterations to the Mining Laws as regards oil are still *sub judice*, and it is hoped that obvious defects will be eliminated or modified so as not to injure the industry.

The future of the Argentine oil industry is full of promise, and both the Government and the private companies are known to be increasing their drilling programmes, while market conditions are such that the industry can hardly fail to be prosperous. G. S.

FUEL ECONOMY IN FLIGHT.—Lieut.-Colonel H. T. Tizard, A.F.C., F.R.A.S. Wilbur Wright Lecture, Royal Aeronautical Society, May 29, 1924.

Three main factors affect fuel consumption in flight: efficiency of the aeroplane, efficiency of the engine, and navigation. The problem of fuel economy in flight may be divided into two parts, (*a*) the principles governing the economic use of an aeroplane, having regard to weather conditions, and (*b*) the design of aeroplanes to obtain maximum efficiency. The author deals with the first part in detail on scientific lines, giving formulæ by which the consumption of fuel per mile may be ascertained, and a table showing the measured and calculated maximum miles per gallon of petrol for several types of machines. As regards engines, the multi-cylinder internal combustion engine has two disadvantages, (*a*) imperfect distribution, resulting in some cylinders being supplied with a richer mixture than others, and (*b*) in the short time available it is impossible to explode completely a mixture containing more than about a 15 per cent. excess of air. The lowest consumption of a multi-cylinder engine of compression ratio 5 : 1 is about 0·52 lb. of petrol per h.p. hour. Experiments with direct injection have yielded interesting results, but the author is doubtful whether this type of engine would be suitable for aeroplanes. Another method is stratification—*i.e.*, arranging the mixing of fuel and air so that after compression the sparking plug is surrounded by a rich mixture, while, near the piston, air is present in excess of that necessary for complete combustion. Preliminary experiments have indicated that with compression ratios of 5 : 1 a consumption of 0·45 lb. of petrol per b.h.p. hour can be obtained. G. S.

GEOLOGICAL.

DIE ERDÖLPRODUKTION POLENS, IHRE VERGANJENHEIT, IHRE GEGENWART, UND IHRE ZUKUNFT.—Dr. Karl Friedl. (Wien). *Petroleum Zeit.*, April 1, 1924, pp. 377–81.

The latter part of this paper contains an interesting summary of the Geology of the Polish oilfields. First the Boryslaw-Tustanowicz Moszinea field is described, and next that of Schodinca-Urycz. These

two fields are represented as of different geological types of oil-occurrence That of Boryslaw is closely dependent upon a large, even, cupola-shaped fold which belongs to the fundamental structure of the Carpathian Mountain system. The Schodinca field is associated with a narrow, lengthy, steep anticline lying within the great over-thrust of the Carpathian border: it is the author's "inner-Carpathian" type, and characterises Western Galicia. Over 70 per cent. of the oil-bearing is credited to the Boryslaw-Tustonowicz-Moazina field, which reached the acme of its production in 1909, and has declined in value since.

The Schodinca-Urycz field has also long since passed its maximum. Dr. Friedl does not consider that either of these fields hold much promise of further important developments. He holds that the best chance in the future is presented by the region between Dolina and Nadeworna, with the oil-fields of Rypne, Dzwiniacz and Bilkow. These belong to the Boryslaw type. J. E. M. H.

Oil Seeking in Kamtschatka. — *Petroleum Zeitschrift*, May 1, 1924, p. 565.

An expedition under the direction of Mr. Polervoy, professor of geology, has returned recently to Vladivostock from Kamtschatka. It reports the presence of naphtha of high quality, which the professor states has a quality superior to that from Saghalien. A large expedition is being organised by the Geological Committee specially directed towards the search for naphtha in Kamtschatka. J. E. M. H.

Prospecting for Petroleum in Australia.—E. C. Andrews. *Economic Geology*, Vol. XIX., No. 2, March.

The author suggests that the failure to find petroleum up to the present time is due to the fact that the conditions which controlled the formation of commercial oilfields of Tertiary age in the principal fields of the world did not extend to Australia. These fields parallel the curves, axes, or zones of the Tethyan, Malaysian, Antillean, Pacific, and Alpine mountain zones. He concludes that if commercially valuable oilfields do exist in Australia they will be found in formation older than the Tertiary. Boring operations in New South Wales, Victoria, Tasmania, Queensland, South and West Australia are cited, all of which were failures. Geological structure was disregarded in granting oil concessions in the last named, some being on closely folded Archæan schists, others on Tertiary limestones, and so forth. In the Northern territory also only negative results have been obtained. As regards the Nusozoic and Kainozoic sediments in Sumatra, Java, Borneo, Ceraca, New Guinea or New Zealand the folding movements affecting them are not characteristic of Australian conditions. A concise account of the geological structure of Australia follows. Four zones of the Archæan nucleus of Western Australia are described: (*a*) the South-Western, (*b*) an outer zone passing through North-West Queensland and the Northern Territory, (*c*) the Inland Plains of Eastern Australia, and (*d*) its plateaux. This area is separated from outlying islands to the north, north-east, and east by deep seas. Palæozoic deposits were formed, but not seriously affected by folding, which was slight and terminated at the close of this era. Shallow water Mesozoic and marine Tertiary deposits occur in the south of the continent; both were eventually elevated into plateaux, but with no folding. Finally this inference is drawn: that the prospects of securing crude oil in commercial quantity in Australia is small, and not to be considered as a business proposition by small investors.

J. E. M. H.

LES GISEMENTS DE PÉTROLE.—I. Ch. Finaton. *La Revue Pétrolifère*, March 8, 1924.

This paper gives a summary account of the geological conditions under which petroleum presents itself all over the world. The author insists particularly upon the relations existing between a lacustrine facies of the mother-rock and the hydrocarbons. The Primary rocks are dealt with first, the earliest (gas) evolution of New York City being placed in the Upper Cambrian. The Silurian forms part of the great petroleum fields of Canada, Ohio, Kentucky, Tennessee and Missouri, the Trenton limestone being assigned the double rôle of parent rock and storage. The Devonian also bears oil in these regions and Pennsylvania, especially in the upper division, in which thick sandstones repose on schists rich in Ganoid remains. These rocks may also be both the source and storehouse of the hydrocarbons. The passage from these beds into carboniferous is insensible in America and coal basins are sometimes superposed on petroliferous areas, or in their neighbourhood. An interesting contrast is drawn between the Primary rocks of America, usually horizontal or very slightly folded, and those of Europe, which, even if forming plains or plateaux, are in general strongly folded, representing the relics of ancient mountain chains; consequently, oil, perhaps originally present in them, has disappeared by long continued oxidation or erosion; whereas, the American sediments, free from disturbance, still hold their oil remains.

J. E. M. H.

LES GISEMENTS DE PÉTROLE—II. Ch. Finaton.—*La Revue Pétrolifère*, April 5, 1924.

This paper, the second, contains a discussion of oil occurrences in the Secondary and Tertiary series. In the former the author estimates its duration as less than half that of the Primary, even if in volume they may equal or surpass the latter strata in volume. He infers that if the bitumenising phenomena proceeded at the same rate during the two periods less hydrocarbons would be formed in the Secondary series. Also the intensity of these phenomena was less in the Secondary, as it was notably a period of relative calm as regards orogenic and volcanic forces. The Triassic era is specially designated as important as a source of oil in France, Germany and Spain, and less so in Algeria and Italy; the lake facies here is indisputable. Depth, restricted areas of local distribution, with slight indications of oil, have militated against its exploitation, to which may be added, at the author's own suggestion, a general supineness in the Latin races! He remarks that if one quarter of the indications found in France and Spain had occurred in America, the regions would by now teem with derricks. Cretaceous oil is mentioned in Rumania and Galicia, probably due to the migration of oil from Miocene strata. Jurassic rocks are unimportant. The Tertiary period of sedimentation is estimated as lasting perhaps one quarter as long as that of the Secondary, and was less intense. The Alpine upheavals of the Miocene period favoured lake deposits, and the fracture of the *manifs* provided oil storage. The bitumenising process was thus favoured in the neighbourhood of the uplifts. Tertiary oil is mainly European. Opinions differ as to its sources; some favour the Flysch of Menstrine facies, others the saliferous mark in the Upper Miocene, migration playing a part. On the two flanks of the Caucasus the oil occurs in the Upper Miocene. On the whole the Tertiary oil seems to illustrate well the author's contention for the connection between the lacustrine deposition and occurrence of oil.

J. E. M. H.

BITUMEN ET PÉTROLES DE MADAGASCAR.—L. Joleaud. *La Revue Pétrolifère.* April 26, 1924.

Madagascar offers the most important shows of bitumen of the French Colonies. M. Léon Bertrand and the author were commissioned by the French Government to examine this island geologically, and this paper gives an account of their observations. The eastern half of Madagascar is formed of gneiss and granitic rocks, which extend westwards over more than half the land surface. Then follow in order Peruvian, Trias, Jurassic, Cretaceous and Tertiary formations in order named, and with comparative regularity parallel to the Mozambique channel. The sediments repose unconformably upon the crystalline rocks, being ushered in by conglomerates and coarse sandstones. Four periods of folding are distinguished: (1) in the centre and east (Caledonian), (2) more to the west (Hercynian), and (3) in Mid-Cretaceous times (the last named affected the previous Hercynian folds, accentuating their anticlines and synclines), (4) Tertiary folds and distortions following approximately a meridian are described in detail. Bituminous appearances always appear in the west of the island, either as bituminous shales or bituminous sands. The former (Jurassic) are not important; the latter (Triassic) occur in large masses, and contain from 10 to 12 per cent. bitumen; they are mentioned as probably valuable, but data are wanting for their complete discussion. Manambolo, Maroboaly and Folakara bituminous areas are described briefly in this paper; Anglo-African societies are noted as having drilled unsuccessfully within the last two, neither of which do the authors consider as favourable. In their view the regions of the Manamboa and of the Banobe contain the most important of the western bituminous rocks, which are Triassic. Finally, the probability of oil accumulations is considered. Regions to the north-east and south-west of Cape Saint André are designated as affording favourable conditions, where large anticlines and a good cover of Triassic and Jurassic beds occur, and which are sufficiently remote from the regions where bitumenising processes have been at work. The Jurassic and Cretaceous zones on the borders of the Trias regions are also recommended for research. Sketch maps accompany the paper.

J. E. M. H.

LE PÉTROLE EN AFRIQUE EQUATORIALE.—J. E. Marshall Hall. *La Revue Pétrolifère*, March 1, 1924.

This gives a short account of an expedition to the Uganda Protectorate, undertaken with the hope of establishing a connection between the known asphalt seepages on the eastern shore of Lake Albert and a reported oil-seepage in the River Nile near Masindi Port. This last-named seepage proved fallacious, marsh gas and a little vegetable oil accounting for the phenomenon. Moreover, Uganda, north of a line joining Fort Portal with Jinja and so on to the Elgon granite area beyond Lake Kioga, and including the area eastwards from the Lake Albert to the same region, was found to exhibit all the indications of a region of regional metamorphism, with few if any true sediments. This region consists largely of a surface covering of Laterite, through which are obtruded the peaks of granite and schistose rocks. The absence of marine transgressions has led to an interesting series of metamorphic and plutonic rocks, altered to a considerable depth by the effects of subaerial denudation. Various stages in the formation of Laterite can be seen at different points, clearly showing the mode of formation from Igneous and Metamorphic rocks. Observations during a short excursion

to the Belgian side of Lake Albert seemed to point to the probable connection between the oil-yielding sediments in the lake, with oceanic conditions of deposition from the Atlantic side. True marine shales were observed to the south of the lake, which extend as far west as Stanleyville and the Congo, where oil-shales have been reported, and even indications of oil itself in the free state. J. E. M. H.

Oil Development in Alaska.—Mr. Alfred H. Brooks (Chief Alaskan Geologist, U.S.A. Geol. Survey). *Oil Engineering and Finance*, May, 1924, p. 264.

In his report of last year's explorations in Alaska, Mr. Brooks states that there are two very large seepages marked by flowing petroleum emanating from small ridges about a mile apart, several miles from the coast near Cape Simpson, fifty miles south-east of Point Barrow, the extreme north of Alaska. The surface exposures are clay shales with hard, thin partings of calcareous shales, which lie nearly horizontal. They are probably of Jurassic age. The survey indicated a wide distribution of the seepage formation. The rocks, slightly disturbed towards the north, show increased folding southwards towards the mountains. The report is not unfavourable to the existence of an oilfield. J. E. M. H.

The New Petroleum Discovery in Germany.—*The Petroleum Times*, May 10, 1924.

At Daunhorst, near Celle, in the Province of Hanover, a well was drilled, and on March 10 this year, at 765 metres, oil and gas issued with estimated production of 25 to 30 tons per day. This Hanover petroleum occurs in salt domes analogous to those of Rumania, Texas, etc., but the former has not proved so productive as yet. The oil is confined to the Triassic system of beds, except where overlying recent beds have become impregnated with oil by migration from subjacent strata. J. E. M. H.

Gypsum Deposits of South-Western Persia.—J. V. Harrison. *Econ. Geol.*, 1924, **19**, No. 3, 259.

The article deals with the gypsum deposits that extend for more than 1000 miles from Lingeh on the Persian Gulf north-westwards into Asia Minor in a band sometimes over fifty miles wide. The lowest horizon at which gypsum is found is 50 ft. below a junction between platy and massive limestones palæontologically determined as Upper Eocene. The massive limestone is followed locally by the Urmi series (Middle Miocene) and, unconformably, by the Fars, the lower division of which (Upper Miocene) is the principal gypsiferous formation. Recent gypsum is also found. In the Eocene the gypsum is massive or banded and porous, and associated with corroded and porous limestone and sulphur; there are indications that it replaces the limestone selectively. Sulphur springs are common in the massive limestone. In the Fars the association is with green and red marls and corroded limestones. The lowest 500 ft. of this series is mainly gypsum. Recent earthy gypsum results from the evaporation of subsoil water, or the action of sulphurous spring waters upon limestone débris. The theory that the gypsum was deposited from sea-water requires the evaporation of 14,000,000 cubic miles of water to one-tenth of its bulk to provide enough gypsum for the Lower Fars alone, leaving out of account the great deposits of adjoining countries. Such enormous quantities make it difficult to accept

the theory. Other views are referred to, but the author favours metasomatic replacement of limestone by sulphurous emanations from below. In the contemporaneous deposits of Egypt, casts of bivalves in selenite show the possibility of replacing limestone by gypsum. Nevertheless, it is believed that part of the Fars gypsum was deposited from solution. The selective action that leaves some limestone beds untouched is probably to be explained by the presence of an impurity acting as a catalyst. "It is probable that the changing of the limestone into gypsum started in the Pliocene and continues to-day."

W. G. W.

Distillation and Refining.

Refining (Petroleum) by Capillary-absorbed Sulphuric Acid.—F. Schulz. *Petroleum*, 1924, **20**, 317–320.

The removal of the colloid substances which cause high colour and turbidity by concentrated sulphuric acid in petroleum refining is principally a physical process, accompanied by subordinate chemical reactions. This process, in a few minutes, reaches a stage of equilibrium, in which the acid sludge reacts with a further quantity of distillate, and the refined distillate with a further quantity of acid, showing analogy with the distribution of a substance between two immiscible solvents. From colorimetric data a curve may be drawn, analogous to the adsorption curve. Acid refining is favoured by low temperature, whereas chemical action is less at low temperature. Decolorisation and clarifying may be carried out by decolorising powders, which have no chemical action. The colouring substances are taken up by acid without any preliminary chemical decomposition. The formation of sulphur dioxide and sulphonic acids commences slowly at a time when the decolourising process is complete and the acid has settled out. The acid sludge contains sulphonated products in true solution and in colloid solution, asphaltic substances, and hydrocarbons mechanically held up. Dried kieselguhr takes up 100 per cent. to 140 per cent. of concentrated sulphuric acid, remaining a dry powder. On treating a spindle-oil distillate with 10 per cent.—15 per cent. of this powder, a light clear refined oil was obtained with a loss of 6 per cent. Similar treatment of machine oil gave a loss of 25 per cent. Filtration of spindle oil or of lignite distillate through a layer of powder 30 cm. thick gave discoloured oils. Kieselguhr saturated with zinc chloride showed no decolourising action, but with sirupy phosphoric acid gave a clear oil, the powder used, thrown into water, giving up a viscous brown oil. A portion of the sulphuric acid used in treating oil remains in colloid solution in the oil, not settling out even in a period of 20 days. H. M.

Acid Treating Process for Petroleum Products.—L. Gurvich. *Petroleum Zeit.*, 1923, **19**, 1239.

A study was made of the distribution of sulphuric acid when agitated with benzine and the stability of compounds formed. 500 gms. of benzine—b.p. 65°–105° C. and sp. gr. 0·746—was shaken for three minutes with 90 gms. of 95·6 per cent. H_2SO_4 and allowed to stand 24 hours. The acid layer then weighed 70 gms. and had an acid concentration of 96·6 per cent., showing that 21·5 gms. of acid had been absorbed by the benzine. On agitating the latter with a 1 : 3 solution of alcohol in water saturated with sodium chloride, 19·2 gms. of acid were recovered, from which it was concluded that the acid forms a loose

combination with the hydrocarbon molecules, which is extremely unstable and is decomposed by cold water or even on standing. F. G. P. R.

CATALYTIC AGENTS—IMPROVED MANUFACTURE OF.—W. A. Patrick. E.P. 212,034, of Jan. 17, 1923.

Silica gel, when made according to E.P. 136,543, consists of a porous structure, containing 3 to 12 per cent. of water, capable of adsorbing 21 per cent. of its weight of water when in equilibrium with water vapour at 30° C. under a partial pressure of 22 m.m. In the state of hydrogel, containing 90 per cent. of water, it is capable of adsorbing considerable quantities of alkali hydroxides from dilute solution following the usual adsorption curve, but will not adsorb acids or salts. The adsorbed alkali will, however, react with salts and thus enables an oxide, hydroxide or basic salt to be precipitated within the pores of the gel whereby an extremely active catalyst is produced. The concentration of the alkali varies between 0·05 and 0·005N according to the quantity of catalytic material to be precipitated, and is all adsorbed after 8–10 hours standing in contact with the hydrogel. The neutral liquor is then drained off and a 0·1 molar solution of iron, aluminium, copper, magnesium, silver, nickel, etc., salt added. After five hours the solution is poured off and the impregnated gel washed with water, dried in air at 75–120° C. and afterwards at 300–400° C. F. G. P. R.

CATALYTIC AGENTS—IMPROVED MANUFACTURE OF.—W. A. Patrick. E.P. 212,035 of Jan. 17, 1923.

The efficiency of any catalytic agent depends on the effective surface exposed to contact with the reaction materials, and it has been found that this object is attained by impregnating a porous material with a colloidal solution of the catalytic agent. The pores, however, should be of such a diameter that they are of the same order of magnitude as that of the colloidal particles, and it has been found that silica gel, prepared according to E.P. 136,543, has the required structure. When a colloidal solution of a metal or metal oxide is allowed to stand in contact with the gel, already saturated with water, the colloidal particles diffuse slowly into the water within the pores of the gel. The solution is then drained off and the gel dried at 100° C. When thus deposited the catalytic material appears to possess a degree of dispersion comparable to the colloidal state and in consequence has the highest degree of activity as a catalyst. F. G. P. R.

GELS—IMPROVED MANUFACTURE OF.—The Silica Gel Corporation and W. A. Patrick. E.P. 212,065 of Feb. 9, 1923.

A method for the preparation of gels of tin, aluminium, tungsten and and titanium oxides either singly or in admixture. A solution of the sodium or other soluble salt of the acid of the oxide in question, varying in concentration from 3 per cent. to 8 per cent., and a quantity of a strong acid, such that the resulting mixture is 0·5N acid, are mixed together with vigorous stirring at any temperature between 15° C. and 80° C. The resulting mixture will remain clear for four to five hours and then set to a firm hydrogel. The latter is then broken up, washed free from acid and salt, dried slowly in a stream of air at 75° to 120° C. for four to eight hours and finally at 300°–400° C. or in a vacuum at 75°–120°. Plural gels of one or more of the oxides and silicon oxide may also be made in the same way. The resulting hard, porous gels are highly efficient absorbing agents. F. G. P. R.

PROCESS AND APPARATUS FOR DISTILLING OIL.—F. W. Sales. U.S.P. 1,490,055 of April 8, 1924. Appl. April 4, 1921.

A continuous stream of crude oil, containing light hydrocarbons is heated to distillation temperature. The vapour is separated from the unvapourised oil and passed slowly through a reflux tower packed with filling material, having an extensive contact surface. The vapour is then separated into its constituents by fractional condensation.

T. A. S.

METHOD OF RECOVERING GASOLINE.—La Van Warren. U.S.P. 1,484,922 of Feb. 26, 1924. Appl. Oct. 6, 1919.

Oil is heated in a container, fields gas being introduced in the pool of oil. Heated oil is sprayed into the space above the oil where it comes in contact with the hot gas. The hot gas, accompanied by gasoline vapour, is passed through a condenser. T. A. S.

IMPROVEMENTS IN OR RELATING TO THE TREATMENT OF MINERAL OILS.—V. L. Oil Processes Ltd. and O. D. Lucas. E.P. 211,864 of Jan. 19, 1923.

In the removal of sulphur compounds from oil by treatment with ammonia (*cf.* E.P. 108,019), it is found that the reaction is reversible and consequently the proportion of products of reaction between the impurities in the oil and ammonia, and the reacting substances should not exceed that at which the reverse reaction takes place. To overcome this difficulty the chief product, hydrogen sulphide, is removed during the treatment by passing the oil through sodium plumbite or stannate solution and then filtering to remove the solids formed before giving the oil further ammonia treatment. The process may be facilitated by the addition of a base metal catalyser, described in E.P. 5847/14. The removal of the hydrogen sulphide may be carried out in liquid phase as described or also in the vapour phase by passing the oil vapours over hydrated iron or lead oxides or over bauxite. T. A. S.

AN IMPROVED METHOD OF TREATING OILS.—G. E. Heyl. E.P. 213,946 of Oct. 7, 1923.

Mineral oil is desulphurised by subjecting it to the action of an electric current traversing an aqueous solution of a suitable metal salt, such as sodium chloride or sodium hydrate. The time of treatment is decreased by the presence of metal or other catalysts precipitated in the pores of coke and packed between the electrode plates. Coke alone may be used as a catalyst. The oil is emulsified with brine and the current may be supplied by lead electrodes dipping into the brine. The current may be direct or alternating and a suitable voltage is 4 to 25 volts., but high voltages may be used. T. A. S.

PROCESS OF TREATING ACID SLUDGE.—E. C. Higgins and O. C. Smith, Assrs. to Coeden & Co.

A mixture of acid sludge and coke or hydrocarbon oil is treated with alkali and agitated by means of steam. A homogeneous oily layer, suitable for fuel, is obtained. T. A. S.

PROCESS OF TREATING SPENT CLARIFYING AND DECOLOURISING AGENTS.—M. L. Chappell, E. P. Wright and M. L. Moore, Assrs. to Standard Oil Co. U.S.P. 1,488,895 of April 1, 1924. Appl. Dec. 28, 1922.

Spent decolourising agents are washed with a colour solvent containing acetone and an acid. T. A. S.

METHOD OF TREATING COLLOIDAL CLAY.—J. L. Weir and J. C. Black. U.S.P. 1,492,184 of April 29, 1924. Appl. Oct. 8, 1922.

Clay for use in refining petroleum, vegetable and animal oils, waxes, sugars and similar substances, is treated with acid not exceeding 10 per cent. in weight of the clay. The products of reaction are not removed.

T. A. S.

USE OF CLAYS IN THE REFINING OF PETROLEUM.—A. Guiselin. *Les Matières Grasses.* March 15, 1924.

(*a*) In the refining of lubricating oils clays have been used to break down emulsions formed during the water washing of lubricating oils after their treatment by concentrated sulphuric acid or by solutions of caustic soda. The agitation of the mixture of oil and water with small quantities of well-dried clay has been found to be an efficient method of breaking down these emulsions.

(*b*) In the refining of cracked oils, owing to the unsaturated condition of the distillates obtained by the cracking of heavy oils, their refining by means of acid and soda is rendered very difficult. The sulphonic acids formed during the treatment by acid combine with the soda to form soaps which are soluble in the oil. In consequence, it is impossible to separate these sulphonic acid soaps either by filtration or by prolonged standing in tanks. Two methods are available for the elimination of these soaps. The first is to treat the oil with dried clay after complete refining with acid and soda. The second is to proceed to the treatment by clay immediately after the acid treatment and separation of the tar. The second method is considered preferable, as it eliminates the formation of emulsions and gives far better refined products.

(*c*) In the refining of redistilled treated oils, lamp oil (kerosene) although quite white after refining with acid and soda, is not found to burn well in lamps. The wicks become encrusted in a few hours and frequent attention is necessary. It is known that the incrustation is composed of mineral matter, mainly sodium sulphate. In order to obviate this trouble with the wicks, treatment by acid must be dispensed with and replaced by an extensive washing with soda, followed by treatment with dried clay. The soda wash is rendered necessary because of the presence of sulphuric acid produced during the distillation.

(*d*) Simplification of plant. Much of the duplication and renewal of agitators or washers can be avoided by the use of dried clay. Acid and soda treatment can be carried out in a single washer. After the elimination of the majority of the tar formed during acid washing, small quantities of well-dried clay, agitated with the oil, will effectively precipitate the last traces of acid tar.

W. H. T.

MOTOR SPIRITS AND OIL FUELS.

REPORT ON HEAVY OIL ENGINE WORKING COSTS.—Diesel Engine Users Association. Feb. 24.

Average working costs per unit generated for the year 1922 of six large English Installations using Diesel engines were as follows :—

Fuel	0·386d.
Lubricating Oil	0·060d.
Water and Stores	0·014d.
Wages	0·224d.
Maintenance	0·100d.
Total	0·784d.

The Annual Plant Load Factor taken over the whole six undertakings was 26·7 per cent. and the Running Plant Load Factor 64 per cent. The average cost of fuel oil was 103 shillings per ton and of lubricating oil 3s. 7d. per gallon.

During the year, 1922—three costs have been obtained for 34 undertakings, of which five are overseas. The average costs of the English stations are as follows :—

Fuel	0·408d.
Lubricating Oil	0·073d.
Water and Stores	0·022d.
Wages	0·296d.
Maintenance	0·188d.
Total	0·987d.

The fuel used per unit was 0·743 lbs. and ·00181 gallons of lubricating oil were used.

In the overseas stations the following costs were obtained :—

Fuel	0·389d.
Lubricating oil	0·112d.
Water and stores	0·019d.
Wages	0·135d.
Maintenance	0·135d.
Total ..	0·790d.

The fuel used was 0·722 lbs. per unit and the lubricating oil 0·00206 gallons per unit.

From valuable comparative data it is noted that some of the fuel consumption considering the load factor are much too high and the average fuel consumption should have been 0·675 lbs. per unit with an average load factor of 59·4 per cent.

A comparison of the lubricating oil used with that of a 320 B.H.P. Diesel engine running under good conditions shew that the 34 undertakings used 63,100 gallons of lubricating oil whereas 16,700 gallons should have sufficed. Even allowing an increase of 100 per cent. to accommodate the idiosyncrasies of the types and combinations of engines used an excess of 29,000 gallons of lubricating oil was used.

T. A. S.

Control of Detonation.—G. A. Young and J. H. Holloway. *J. Soc. Automotive, Eng.*, 1924, **14**, 315.

Control of detonation can be obtained by the use of anti-knock chemicals or by means of reducing the temperature of the walls of the combustion chamber so that the charge can be maintained at a lower temperature prior to normal ignition, thus insuring normal combustion. A compression of 125 lbs. can be used without detonation by the addition of a small amount of anti-knock material to the fuel, the increased efficiency being sufficient to warrant the extra expense, provided the mixture, spark plugs, valves and combustion chamber are maintained at the proper temperature.

F. G. P. R.

Liquid Fuel.—E. H. Records. U.S.P. 1,491,275, April 22, 1924. Appl. Sept. 17, 1923.

The fuel consists of

Alcohol	81·50	per cent.
Benzol	10·00	,,
Ethyl Ether	5·00	,,
Naphthalene	3·5	,,

T. A. S.

MOTOR FUEL.—T. Midgley, Assr. to General Motors Research Corporation. U.S.P. 1,491,998 of April 29, 1924. Appl. Oct. 4, 1918.

The fuel for use in internal combustion engines, consists of a "eutectic" mixture of cyclohexane and benzene. T. A. S.

SYNTHETIC LIQUID FUEL.—H. A. Jacobs. U.S.P. 1,489,763 of April 8, 1924. Appl. Oct. 30, 1922.

The synthetic liquid fuel consists of benzol, ¼ to 1 gallon, naphthol 1 to 3 lbs., kerosene ¼ to 1¼ gallons, lubricating oil ¼–½ gallons, carbon bisulphide 1/16–¼ gallon. The mixture may be mixed with gasoline. T. A. S.

SUBSTITUTE FUEL OIL.—J. J. Kirby, Assr. to General Oil Co. U.S.P. 1,488,009 of March 25, 1924. Appl. March 30, 1921.

A mixture is made of 3 quarts of water, 2 ounces of glycerine, 2 ounces of soap, 3 pints of crude oil, 3 pints of gasoline, 2 quarts of kerosene, 1 pint of ammonia, 3 ounces of ether, 3 pints of naphtha and 3 ounces of alum. The mixture is boiled until the gasoline, ammonia, naphtha and ether are evaporated. The mixture (2½ gals.) is diluted to 25 gallons, with a mixture of one part of crude oil with 2 parts of gasoline. T. A. S.

[MPROVEMENTS IN PROCESS OF MAKING LIQUID FUEL.—R. A. Butler. E.P. 213,628 of Nov. 31, 1922.

Liquid fuel is made by emulsifying oil and water in the presence of a small quantity of alkali. A suitable mixture consists of hydrocarbon oil 35 parts, water 64 parts, alkali 1 part. The emulsification is brought about by heating the mixture to boiling point when complete emulsification results. T. A. S.

FUELS FOR MOTOR SHIPS: RESULTS OF THE CENTRIFUGAL TREATMENT OF DIESEL AND FURNACE OIL.—H. Moore. *Motor Ship*, 1924, **5**, 82–84.

As coal-tar products command high prices for other industrial purposes, practically all fuel now employed on Diesel engines is of petroleum origin. As petroleum has a very low ignition point, ignition difficulties are seldom encountered. Possible sources of difficulty in burning the oil are asphalt, water and mechanical impurities. Asphalt is completely combustible. The usual content of asphalt in Diesel fuel oil is hard asphaltum 2 per cent. and soft asphaltum 6 per cent. approximately. As asphaltum is evenly distributed throughout the mass of the oil the engine seldom gives any trouble, and the walls of the combustion chamber remain clean. Difficulties are usually occasioned by mechanical impurities and water. Water is not dissolved or finely suspended throughout the fuel, but is irregularly distributed in pockets, which, when drawn into the engine by the fuel pump, cause misfiring, loss of speed, and subsequent overloading of the engine to regain its speed. Irregular firing causes deposits in the combustion chamber, and the contaminated lubricating oil causes a drag between piston and cylinder and may cause seizure. Smoking at the exhaust accompanies irregular firing. Mechanical impurities cause obstruction of pulverising devices and wear on the needle valve face, and the accumulation of ash on the cylinder walls, increasing the wear on piston rings, pistons and cylinder walls. Centrifugal treatment has often been used to remove water and mechanical impurities from fuels, such as carburetted water-gas tar, and is being adopted on a large scale by Diesel engine

tsors. Many analyses have been made on fuel oil before and after centrifugal treatment recently. The specific gravity, coke value, and asphaltum content undergo little change by the treatment. The flash point is sometimes raised a few degrees. The water is almost entirely removed. The ash is generally reduced to one-half or two-thirds in viscous oils, and almost totally removed from lighter oils. The results of treatment on a commercial-size centrifuge are generally more satisfactory than on the laboratory machine. The treatment of Diesel fuel oil on a laboratory centrifuge showed a reduction in coke, from 2·93 per cent. to 2·56 per cent.; ash, 0·027 per cent. to 0·020 per cent.; mechanical impurities, from traces to nil; water, from traces to nil; soft asphaltum, 2·20 per cent. to 1·90 per cent.; hard asphaltum, 1·06 per cent. to 0·98 per cent. (or, by the 40°/60° petrol method, from 4·02 per cent. to 3·62 per cent.). Furnace oil treated underwent similar changes. The deposit from the bowl of the centrifuge operating on heavy Mexican oil contained 25 per cent. of ash; the deposit from Diesel oil, 18·75 per cent. of ash. The nature of the deposit, and the striking difference in appearance of the oils before and after treatment, is shown in microphotographs. The result of treatment as regards diminution of ash appears to be greater as seen in the microphotographs than is shown by the analysis, and it is supposed that a portion of the ash is in solution in the oil. The practical result on the working of engines, as stated by Mr. Keller, of Wm. Doxford & Sons, is that the improvement by treating is beyond question. Samples from large scale working on the M/S *Sycamore*, on oil with a rather high ash and water content, showed great reduction of ash and practical elimination of water. An analysis of the deposit showed 48 per cent. of water, 7·9 per cent. of ash and 45 per cent. of oil. The ash contained 5·3 per cent. of silica, 34·4 per cent. of iron oxide, sodium chloride and sulphate, and traces of calcium, magnesium and potassium salts. The water separated by the centrifuge had 3·3 per cent. of solid contents, an amount closely corresponding to the proportion of solids in sea-water. Out of 0·102 per cent. of ash found in the original oil, the water content, 2·6 per cent., which was almost entirely removed, thus accounted for 0·086 per cent. of ash, leaving 0·016 per cent., an amount usually found in dry oil. Much of the ash contents of wet oils is probably due to the salts dissolved in the water. The value of the centrifuge is most marked when the oil is inferior or irregular in composition, and especially for furnace oils. H. M.

Cracking.

Problems in the Refining of Cracked Distillates.—J. C. Morrell. *Chem. & Met. Eng.*, 1924, **30**, 785.

The paper describes some methods of treatment capable of dealing with the products obtained from the cracking of various types of oils, including the heaviest residues of Mexican and South American origin. The high sulphur and asphaltic character of these oils make the distillates particularly difficult to refine, yet the methods outlined below are capable of giving a sweet water white spirit that is stable under marketing conditions. Three practical methods are given with alternative variations:—

1. Applicable only to types easily refined. (*a*) Agitation with sulphuric acid (66 Bé) 2–6 lb. per barrel, (*b*) water wash, (*c*) caustic soda wash, (*d*) water wash, (*e*) distillation with open steam.

2. This is suitable for most oils and finds general application. (*a*) Agitation with sulphuric acid (66 Bé) 15–20 mins. for 1000-barrel batch, settle and draw off sludge, (*b*) water wash usually 5–10 mins., (*c*) agitation with plumbite solution until immune to "doctor" test (20–30 mins.), (*d*) water wash avoiding formation of emulsion, (*e*) distillation with open steam. The plumbite solution consists of litharge ·05–·2 lb. per barrel of distillate, dissolved in 16–30 Bé caustic soda solution. This solution is recovered after use by settling and drawing off the clear liquor and more litharge added. In some cases it is desirable to precede the plumbite treatment with a caustic soda wash, this having the effect of preventing the formation of suspended matter and emulsification and also, of course, economy in litharge.

3. This is useful in dealing with oils that cannot be successfully treated with the previous methods. (*a*) Agitation with plumbite solution, (*b*) water wash, (*c*) agitation with sulphuric acid, (*d*) water wash, (*e*) caustic soda wash, (*f*) water wash, (*g*) distillation with open steam. This can be varied by giving a second plumbite treatment instead of the caustic soda wash. In certain cases it is necessary to complete these treatments by filtration through absorbent earths in order to produce an entirely stable product. The plumbite solution is used without the addition of sulphur on account of the solubility of sulphur in the oil. The author believes that the plumbite reacts with those unstable unsaturated bodies in addition to the sulphur compounds, but its action varied considerably with different oils. The redistillation of cracked distillates requires special care, owing to chemical changes that may take place as a result of prolonged heating. A continuous system of distillation with open steam is advocated, using a properly proportioned column and carefully regulated temperature control. S. B.

Apparatus for Cracking Hydrocarbons and Recovering Gasoline.—M. H. Kotzebne and L. M. Bowman. U.S.P. 1,485,083 of Feb. 26, 1924.

A cracking tube, passing through a heater, is packed at the inlet end, with alternate plugs of steel wool and gravel separated by perforated discs. At the outlet end of the tube is fixed an aperture outlet plate, there being an otherwise unobstructed passage through the heating tube. T. A. S.

Improvements in Installations and Devices for the Distillation and Depolymerization of Liquid or Liquefiable Hydrocarbons.—A. A. F. M. Seigle. E.P. 1,090,723 of March 20, 1924. (Appl. Dec. 20, 1923.) Conv. (France) Dec. 22, 1921.

Preheated oil is distilled at the bottom of a centrally heated vertical retort packed with chips of aluminium, copper and nickel. The vapours pass upwardly through the retort and by means of baffles are caused to come in contact with the walls. On leaving the retort the vapours have a temperature of 600° C. On leaving the retort the vapours pass through two expansion chambers fitted with hot water jackets. The first expansion vessel is maintained at a temperature of 250–300° C., and is partially filled with metal chips which serve as a catalyst. The second expansion vessel is maintained at 180° C. Vapours not condensed are passed through coolers of the ordinary type. The whole cracking operation is carried out at atmospheric pressure. T. A. S.

Process for Treating Petroleum.—C. P. Dubbs, Assr. to Universal Oil Products Co. U.S.P. 1,488,325 of March 25, 1924. (Appl. June 21, 1919.)

Oil is passed, under pressure, through tubes set in a furnace, where it is heated to cracking temperature. It is then delivered into an enlarged

chamber fitted with vapour off-takes and a drain. The vapours pass to a dephlegmator where, in condensing, they heat tubes through which oil is passing into the system. The whole apparatus is maintained under pressure. Any condensate from the dephlegmator is added to the ingoing oil stream. Carbon containing residue is drawn from the enlarged chamber and not allowed to re-enter the system. T. A. S.

METHOD AND APPARATUS FOR REFINING HYDROCARBONS.—C. R. Burke, Assr. to L. P. Burke. U.S.P. 1,487,438 of March 18, 1924. (Appl. Jan. 20, 1922.)

Oil is cracked in stills and the vapours passed through narrow tubes into a vessel placed above the stills and containing oil. The heavier portions of the vapours are condensed and are returned to the stills through the narrow pipes. An additional pipe and pump permits oil to be drawn from the vessel and delivered into any of the stills.

T. A. S.

IMPROVEMENTS RELATING TO THE TREATMENT OF LIQUID HYDROCARBONS AND MORE ESPECIALLY CRACKED SPIRIT.—F. G. P. Remfry. E.P. 212,500 of March 20, 1924. (Appl. May 22, 1923.)

Cracked spirit is treated in the liquid phase by passing it upwards through a heated filtering medium such as bauxite, fullers earth, floridin, porous silica or activated charcoal. The contact material is maintained at 100–130° C. The unsaturated bodies are polymerised, and on passing the liquid through a cold filtering medium such as bauxite they are removed. The process is applicable to all petroleum distillates and light hydrocarbons. T. A. S.

IMPROVED PROCESS AND APPARATUS FOR THE MOLECULAR CONVERSION OF HYDROCARBON OILS AND THE SEPARATION OF RESULTANT PRODUCTS.—G. P. Lewis. E.P. 213,295 of Sept. 27, 1922.

Liquid hydrocarbons, which may be mixed with powdered solid carbonaceous matter such as coal, alkalies, alkaline earths, borax, bauxite, alumina, metallic or other chlorides is passed at a pressure of 100–300 lb. through tubes heated to 350–500° C. The oil, after passing through a regenerative apparatus, where oil for further treatment is preheated, is allowed to escape through nozzles into chambers at lower pressure, where much of the oil is vapourised. The chambers are maintained at 160°–300° C., and may be packed with catalytic refining materials, or high tension electric currents may be passed through the chambers. Hydrogen or hydrogen containing gas may also be pumped into the oil chambers to assist in hydrogenating the oil. T. A. S.

PROCESS FOR DISTILLING AND CRACKING OILS.—V. T. Smith. U.S.P. 1,490,862 of April 15, 1924. (Appl. March 5, 1923.)

Oil is caused to descend through a layer of burning carbonaceous matter, the temperature increases as it approaches the bottom of the layer. The vapours produced are passed laterally through a layer of burning carbonaceous material maintained at a constant temperature in the path of the vapours, which are thereby cracked. T. A. S.

PROCESS AND APPARATUS FOR DECOMPOSING HYDROCARBON OILS AND WATER AND RE-COMPOSING THE PRODUCTS THEREFROM.—J. L. Murrie. U.S.P. 1,492,305 of April 29, 1924. (Appl. March 27, 1922.)

Water is superheated, under pressure, and mixed with oil. The mixture is conveyed to a vapourising chamber, where the vapours are projected

against an obstructing substance. The vapours are then taken, under pressure, through a specially heated converting coil and subsequently condensed. T. A. S.

PROCESS OF REFINING OIL.—B. V. Stoll. U.S.P. 1,492,273 of April 29, 1924. (Appl. October 28, 1919.)

Oil is heated to cracking temperature under a pressure of 100 lb. per sq. in. It is then expanded at a lower temperature and under a pressure of 80 lb. per sq. in. At the moment of expansion it is atomised with steam. T. A. S.

IMPROVED PROCESS FOR HYDROGENATING HEAVY MINERAL OILS, COAL, DISTILLATES, COAL SLIMES OR OTHER HEAVY HYDROCARBONS AND RAW PRODUCTS OBTAINED THEREFROM.—Internationale Bergin Compagnie voor Olie en Kohlen-Chemie. E.P. 213,661 of Jan. 2, 1923.

In the production of light hydrocarbons from heavy oils, coal slimes, etc., by treatment with hydrogen at high temperature and pressure, the necessity for previous desulphurising is avoided by carrying out the hydrogenation in the presence of a metal of the sodium group. By this treatment sulphur compounds are eliminated and more complete hydrogenation takes place. In the treatment of Mexican Panuco oil 5 per cent. of sodium is used. T. A. S.

THE CRACKING PROCESS OF BURTON.—H. I. Waterman and H. J. W. Reus. *Receuil des Travaux chimiques des Pays-Bas*, **45**, 1924, 87.

As is well known, at the cracking process of Burton stress was laid on the interposing of the pressure valve behind the condenser. In interposing the pressure valve between the still and the condenser, condensates would be obtained, containing many olefines.

However, the earlier researches of B. T. Brooks, R. F. Bacon, F. W. Padgett and J. W. Humphrey (*J. Ind. Eng. Chem.*, 1915, **7**, 180) showed that this conclusion concerning the unsaturation of the distillates is not right. Brooks and others used as criterion in their researches the iodine number and the refining loss with sulphuric acid. Now this question also is of great interest for the practice of the cracking processes ("Cracking Patents," *Journ. Inst. Petroleum Tech.*, 1923, **9**, 37, 38A). The experiments were carried out with a fraction (sp. gr. 0·995) of a heavy Borneo crude (free from sulphur) of bromine number (addition according to McIlhiney) = 2·0.

The temperature during the experiment was 437° C. The table shows the results of the experiments :—

Number of the experiment :	IV.	VI.	V.	VII.
	Condensation without pressure.		Condensation under pressure according to Burton's method.	
Percentage of distillate (and oil separated in the foam-separator) ..	30+8	35·6+4	28+7	35+5
Bromine number (addition) of the distillate ..	20·8	17·0	27·2	28·7
Sp. gr. of the dist. ..	0·873	0·898	0·858	0·833
Percentage of residue ..	32	30·4	39	40
Percentage of gas ..	20·3	14·3	17·2	18·7
Sp. gr. of gas	0·00105	0·00104	0·00104	0·00103
Percentage loss	9·7	9·7	8·8	1·3

Although the duplicate experiments do not give quite the same results it is clear that with the oil used, and the way in which the experiment has been carried out, the condensation under pressure according to Burton does not lead to saturated distillates.

Working according to Burton, the unsaturation of the distillate is certainly not less than in condensing under ordinary pressure.

At the same time was observed that the bromine numbers of the distillate remained constant during a long period.

When the same experiments were repeated after adding 5, 10 and 15 per cent. $AlCl_3$ respectively, with the same temperature and nitrogen pressure, they produced more saturated distillates it is true, although a complete saturation was not attained. H. I. W.

Lubricating Oils and Waxes.

The Action of Metals and Combinations of Metals on Transformer Oils.—H. von der Heyden and K. Typke. *Petroleum*, 1924, **20**, 320–325.

Experiments on the changes produced in oils when sludge is formed were made on 150 g. of oil in a 300 cc. flask, in which was a metal sheet 25 × 30 mm., by heating to 120° for 70 hours. At first 1–2 bubbles of oxygen per sec. were introduced: afterwards the oils were heated without oxygen in a flask with a perforated cork. The sludge formed was found in most cases to consist of metallic soaps. The results given refer to the oils settled off the sludge, if such was formed. When they were determined on the oil and sludge taken together they were generally 5 per cent. higher for the greatest sludge formation, but little different for slight sludge formation. A figure obtained by multiplying the acid value and the sludge value is given as a convenient expression of the degree of action of the metal upon the oil. The experiments were made with single metals and also with combinations of metals. Tables of the results are given. When oxygen was employed the greatest action took place with the metals in the following order: weathered copper, bright copper, brass and tinned copper; and without oxygen: bright copper, weathered copper, oxidised copper, tinned copper. Many combinations of metals were tested, and high values obtained with oxidised copper and black iron, bright copper and zinc, and bright copper and iron. Zinc and aluminium in combination with oxidised copper had slight action, but with bright copper were very active. The results are applicable to the behaviour of turbine oils. H. M.

Mechanical Friction as Affected by the Lubricant.—L. H. Pomeroy. *J. Soc. Automotive Eng.*, 1924, **14**, 307.

The relationship between friction in automobile engines on the one hand and petrol consumption and thermal efficiency on the other are discussed. Water jacket temperature appears to have little effect on the thermal efficiency, and the saving by means of thermostats and radiator shutters is due almost entirely to reduction in viscosity of the lubricating oil. F. G. P. R.

Improved Solutions of Non-mineral Oils with Mineral Oils and a Process for their Manufacture.—A. G. Marshall. E.P. 211,978 of Dec. 2, 1922.

When a suitable non-mineral oil is mixed with a mineral oil, two solutions are obtained, one of mineral oil in non-mineral oil and the other

of non-mineral oil in mineral oil. The mainly non-mineral oil solution contains more mineral oil than can be taken up when non-mineral and mineral oils are merely blended together. Both solutions are suitable for use as lubricants in internal combustion engines. The solutions may be prepared by heating together the mineral and non-mineral oils—*e.g.*, 12 parts mineral oil of viscosity 600 Saybolt at 100° F., and 7 parts castor oil to 60° C. The mixture is then cooled to 20° C., when separation into two layers takes place. Solutions of varied character can be obtained by varying the proportions of the oils and the temperatures of separation. T. A. S.

Coal, Shale, Pitch and Asphalt.

Asphalt-bearing Rocks as a Source of Mineral Oils and Lubricants.—C. Manuelli. *Indust. Olii. e Grassi*, 1923, **3**, 18–20.

A description is given of the early efforts to distill bitumens in Italy, and the recent successes obtained by means of distilling the rock direct in place of first separating off the bitumen. Circular retorts of 40–100 tons capacity per 24 hours at a temperature of 500–600° C. are employed, heating being done by means of a part of the bitumen. A mixture of oil and gas is obtained, the latter containing 10·6 per cent CO_2, 4·8 per cent. CO, 64·4 per cent. CH_4 and 20·2 per cent. unsaturated hydrocarbons. The oil, which is dark red, transparent, non-drying and contains no resins, yields lubricating oils by the action of steam, air, or inert gases. The hot residue from the retorts is cooled to 42° C. by heat transference to the air required for combustion, and is used as CaO.
F. G. P. R.

Method and Apparatus for Destructively Distilling Petroleum or Mineral Oil from Oil Shales, Bituminous Coal and other Hydrocarbonaceous Material.—A. Stalli. E.P. 213,046 of Jan. 22, 1923.

Shale is distilled in a retort, the heat of combustion of the shale being used to liberate the hydrocarbons. The natural draught of the apparatus conveys the gases to the condenser. An automatically controlled hopper maintains the supply of shale to the retort and mechanical means are supplied for the periodic discharge of the spent shale. A series of condensing towers is packed with pebbles of graduated sizes. T. A. S.

Apparatus for the Fractional Distillation of Oils from Oil-shale or Similar Material.—D. K. Fairweather. E.P. 212,770 of March 20, 1924. (Appl. April 18, 1923.)

A vertical shale retort is fitted with external and internal heating flues. Vapour traps are provided and also means for creating steam sprays or screens for the purpose of dividing the retort into a series of distillation chambers. Means are also provided for the continuous charging and discharging of the retort without allowing the escape of vapours. By gradual and controlled heating of the retort and the removal of the vapours immediately they are set free, excessive cracking is avoided. The product requires less after treatment than oil produced by other methods of distillation. T. A. S.

Apparatus for Distilling Oil Shales and the Like.—D. J. L. Davis and G. W. Wallace, Assrs. to G.E. Co. U.S.P. 1,491,290 of April 22, 1924. (Appl. Sept. 20, 1922.)

Oil is extracted by burning shale in a vertical retort fitted with a removable bottom closure to permit of the discharge of the spent shale.

The bottom closure consists of an oil receptacle surmounted by a grate and makes a tight fit with the bottom of the retort. Combustion proceeds down the retort. T. A. S.

OIL-SHALE DISTILLATION APPARATUS.—H. Groves and D. E. Lain. U.S.P. 1,490,463 of April 15, 1924. (Appl. Feb. 4, 1921.)

The retort consists of two circular concentric shells with an intervening retort chamber. Pipes connect both inner and outer chambers with the retort space, the pipes being spaced and staggered. Hot gases are caused to flow from the outer to the inner chamber through broken shale contained in the retort space. T. A. S.

PROCESS FOR TREATING OIL SHALE.—J. B. Jenson. U.S.P. 1,490,213 of April 15, 1924. (Appl. Sept. 18, 1919.)

Shale is passed through a series of progressively heated chambers, the vapours from each chamber being condensed separately. The condensates from some of the chambers are revolatilised by bringing them in contact with the shale in the hottest chamber, the spent shale carrying off particles of carbon or other solids produced in the operation. T. A. S.

APPARATUS AND METHOD OF EXTRACTING THE PETROLEUM CONTENT FROM PETROLEUM-BEARING SAND OR SHALE.—J. Coogan. U.S.P. 1,487,541 of March 18, 1924. (Appl. April 16, 1920.)

Bituminous sand and similar material is agitated with water, and during the agitation petroleum solvent is added. The bituminous matter is washed out of the sand and floats on the surface of the water. T. A. S.

APPARATUS FOR SEPARATING OIL FROM OIL SHALE.—W. R. Smith. U.S.P. 1,490,945 of April 22, 1924. (Appl. Feb. 7, 1923.)

Shale is fed by means of an air-excluding conveyor into the top of a vertical retort, and falls through an internally heated zone in which it is destructively distilled. The vapours are drawn off into a condensing conduit and the condensed liquid is pumped to storage, the pump maintaining a slight suction on the retort. Part of the volatilised products is pumped to the bottom of the retort to supply material for combustion. The spent shale is discharged at the bottom of the retort through an air-excluding device. T. A. S.

INVESTIGATIONS OF OIL SHALE KEROGEN BY THE FRACTIONATION OF THE PRIMARY BITUMEN IN HIGH VACUUM AND BY ORGANIC EXTRACTIONS. By Chester Oklahoma Blackburn. *Quarterly of the Colorado School of Mines* **19**, No. 2, April, 1924.

The investigation comprised a study of the constituents in a shale kerogen obtained from typical Elko, Nevada, shale. The following is an average of several promixate analyses of Elko shale :—

	%		%
Moisture	4·50	Volatile	22·19
Fixed carbon	13·36	Ash	60·42

Other constituents are as follows :—

Nitrogen, 0·43% (theoretical available $(NH_4)_2SO_4$, 40·5 lb./ton.
Oil yield, 32·52 galls./ton. Sulphur = 4·10%.

The retorting of the shale kerogen was carried out in an electrically welded retort, with the aid of a partial vacuum, in order to obtain

primary bitumen. Twenty-five retortings were carried out, and bitumens varying in colour from yellowish brown to dark red were obtained. The colour varied according to the degree of oxidation of the distillate. In these retortings, the first drop of light oil appeared at an average temperature of 192° C. with a vacuum of 217 mms. Hg. Heavy bitumen was first obtained at 273° C. with a vacuum of 305 mms. Hg. The following is a list of the average values from crude retortings :—

Retorting time	6 hrs. 22 mins.
Gallons of oil (bitumen) per ton	40
Specific gravity of oil at 15·5° C.	0·878
Cubic feet of water—insoluble gas per ton	1563
Pounds of water—insoluble gas	78·52
Pounds of water—soluble gas	110·50
Pounds of spent shale per ton	1454

High vacuum fractionation of primary bitumen was next undertaken in order to separate the various hydrocarbons present, without additional cracking. The fractionations were carried out in a vacuum of below 4/1000 mm. pressure. The following is a list of the fractions obtained, together with their analyses and physical properties :—

Fraction No.	Temp. Cut. °C.	% by Wt.	S.G. at 60° F.	Iodine value.	Saponification No.	% Nitrogen.	Acidity = mg KOH per 1gm. oil.	Corrosion test 2 hrs.	Refractive Indices /21° C.
Volatile oil	—	5·62	·7925	122·5	—	·169	—		1·4430
1 ..	27–65	13·40	·8450	110·8	—	·330	3		1·4465
2 ..	65–100	11·33	·8074	97·4	—	·402	—		1·4840
3 ..	102–142	14·92	·8820	87·3	—	·438	—		1·4920
4 ..	135–147	6·95	·8945	85·7	—	·473	—		1·4980
5 ..	142–156	7·19	·8986	84·4	—	·486	—		1·5000
6a ..	156–200	9·49	·8980	66·1	14·55	·482	10·99	Oil corroded polished steel very rapidly, forming deep pits.	—
6b ..	158–200	9·24	·9030	77·0	—	·498	10·86		1·5028
7 ..	208–235	11·42	·0358	63·6	—	·597	—		—

It was found that the fractions, on being released to the action of the air, became darker in colour, in some cases with rapidity. Extractions were carried out on the powdered shale, firstly using chloroform as a solvent. About 4% of montan wax was extracted, and from this, montanic acid ($C_{27}H_{55}COOH$) was isolated. Secondly, using methyl alcohol as a solvent, a mixture of montanic acid derivatives (M.P. 62·5° C.) was obtained. Thirdly, prolonged extraction with boiling water served to isolate ferrous and ferric iron, calcium, magnesium and manganese sulphates.

From the fourth high vacuum fraction, using acetone as a solvent, Heneicosane ($C_{21}H_{44}$) (M.P. 40·2° C.) and a crystalline substance (M.P. 31° C.) belonging to the olefine series were isolated. From the sixth fraction, using methyl alcohol as an extracting medium, Heptocosane ($C_{27}H_{56}$—M.P. 59·6°—S.G. at M.P. 0·779) was obtained ; 70–75% of the fraction being composed of this compound.

Summary and Conclusions.

1. Some of the results of this investigation substantiate the theories and experimental work of Engler, with reference to the chemical nature of kerogen.

2. A study has been made of the constituents in shale kerogen from a typical Elko, Nevada shale, by the following means :—

(*a*) Retorting shale kerogen in partial vacuum, obtaining a true primary bitumen.
(*b*) High vacuum fractionation of primary bitumen.
(*c*) Relative analysis of fractions.
(*d*) Organic extraction on powdered shale.
(*e*) Organic extractions on primary bitumen and high vacuum fractions.

3. Retorting in vacuo reduced the amount of cracking with a consequent increased oil yield. Under these conditions a true primary bitumen was obtained.

4. Under similar conditions the first drop of light oil appeared from the condenser at 192° C., and the first drop of semi-solid bitumen at 273° C. The average of these two values, or 232° C., represents the temperature at which excessive decomposition of kerogen probably commenced. For most shales, the initial decomposition temperature at ordinary conditions of pressure is 365° C., which is approximately true for Elko oil shales.

5. Conclusive evidence was obtained to show that almost no cracking took place during high vacuum fractionation. About 82% of the primary bitumen was fractionated without notable cracking.

6. Montan wax was extracted from powdered shale from which montanic acid was extracted and purified.

7. The evidence obtained from this investigation seems to indicate that the oil forming constituents in Elko, Nevada, shale kerogen are polymerised products of montan wax, which, upon thermal decomposition, depolymerises, and forms, first, a primary bitumen—montan wax ; then secondary products, or true oils, the results of a cracking process.

8. Heptocosane ($C_{27}H_{56}$) was extracted from the primary bitumen ; also from the last two high vacuum fractions.

9. All evidence from this research points to heptocosane as the highest member of the paraffin series of hydrocarbons obtained from the depolymerisation of the kerogen constituents, with subsequent cracking of the montan wax derivatives into their respective paraffin.

10. Conclusive evidence was obtained to show that Elko shales contain some oil as such. It is a rather common belief that oil shales contain no oil. This statement is certainly not true, at least, for average Elko shales. Whether the small quantities of oil found in raw shales is absorbed oil from an old oil field, or whether it has been formed from kerogen constituents by pressure and friction during the period of formation, is a doubtful question ; but the author feels certain that the latter explanation accounts for these mechanically held oils.

11. Many interesting physical and chemical properties were determined on high vacuum fractions.

12. Several new alum like compounds were extracted from Elko shale.

W. H. T.

PETROLEUM DIVISION

OF THE

AMERICAN CHEMICAL SOCIETY.*

The Division of Petroleum Chemistry met Thursday and Friday mornings, April 24 and 25, at the Central High School. Both meetings were well attended. The programme of papers aroused much valuable discussion.

The paper read by O. L. BARNEBEY entitled "Application of Adsorbent Carbon in the Petroleum Industry" had to do with the application of the material to adsorb gasoline from natural gas. He mentioned the fact that adsorption carbon must be nonfriable and of high quality, and the best size and mesh is 16 to 14. He brought out the fact, however, that material finer than this gave better service where low gas velocities were encountered in that the saturation of the gasoline could be carried higher with fine mesh charcoal, but fine mesh charcoal cannot be used with high velocity gas because of the resistance it opposes to the flow of gas in main gas lines. It costs money to compress natural gas and the charcoal towers impose a high resistance, hence more pressure must be carried on the gas stream to force the gas through the charcoal. He brought out the fact that while many attempts have been made to produce activated charcoal from other materials, yet the substance from which practically all of it is made to-day is cocoanut shell.

G. L. WENDT's paper on "A Theory of the Mechanism of the Action of Anti-knock Compounds" aroused a great deal of interest and considerable discussion. Dr. Wendt proposes as a theory which may satisfactorily explain the mechanism of the action of anti-knock compounds one which has to do with an electronic mechanism. He states that combustion releases electrons which travel at high velocities before the flame front and seem to be responsible for detonation. But when tetra ethyl lead vapours are added the number of ions present are reduced and the removal of electrons by this process serves to decelerate the velocity of flame propagation.

EDWARD SOKAL presented a paper entitled "The Chemical Structure of the Internal Combustion Engine." He represents the Katalite Corporation of New York City, which corporation proposes the use of an oxide on the piston of an internal combustion engine to influence combustion. He claims that comprehensive tests have shown that this method produces highly desirable results in accelerating and completing combustion, decreasing carbon formation and decreasing detonation. However, a representative of the Bureau of Standards and one from the General Motors Research Corporation maintained that they had tried out the catalyst with negative results.

T. A. BOYD, of the General Motors Research Corporation, read a very interesting paper on the "Relative Effects of Some Nitrogen Compounds upon Detonation in Engines." This is the continuation of the exceedingly interesting and valuable work this corporation is doing upon anti-knock compounds. Mr. Boyd stated that in general the nitrogen compounds which are most effective for suppressing detonation are the primary and secondary amines.

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* From Ind. Eng. Chem., News Edn., **2**, I., May 10th, 1924.

R. R. MATTHEWS, of the Roxana Petroleum Co., read a paper on the "Determination of Dilution of Crank Case Oil." One method he proposes is the regular Bureau of Mines method, and another is a slight modification. Both methods check closely. This is an important determination in that a great deal of crank case dilution takes place, and it is important that reliable methods be used to detect the dilution with the gasoline.

C. E. WATERS, of the Bureau of Standards, proposed a method called the "Bichromate Number of Petroleum Oils" for determining oxidation of oil. By this method oils are partially oxidised by a solution of bichromate in dilute sulphuric acid. Mr. Waters brought out that there is great need for more accurate tests than have heretofore been used and asked that work be done by others along this line to determine its suitability.

One of the most important papers read before the division was that read by W. A. PETERS, junr., on the "Separation of the Constituents of Petroleum by Fractional Distillation." Mr. Peters brought out the fact that, compared to fractionation methods used by some industries, many of those used in the petroleum industry, that is, the columns used, are unwieldy, unnecessarily expensive and inefficient.

The paper by A. R. FORTSCH and ROBERT E. WILSON, on the "Viscosity of Oils at High Temperatures," brought out the fact that it is possible to obtain the viscosity of practically any oil derived from Mid-Continent crude at any temperature up to 550° F. to within a few per cent., given a single reliable determination of its viscosity at ordinary temperatures. This is important, because industries are largely interested in the viscosity of oils at high temperatures, and not so much at the temperatures at which tests are usually made. This has particular reference to the automobile industry.

The paper by R. E. WILSON and D. P. BARNARD, entitled "Dew-Points of Gasoline-Air Mixtures," largely resulted from certain discrepancies existing between the work of these investigators and that of W. A. Gruse. It was brought out that for fuels ordinarily encountered, the dew-point observations of Wilson and Barnard and of Gruse check when a correction is made by the former authors.

W. H. BAHLKE and R. E. WILSON discussed "Boiling Point Correction Chart for Normal Liquids with Special Application to Petroleum Products." These authors brought out the fact that the existing correction table in Bulletin 323 of the Bureau of Mines appears to be in considerable error, but corrections in it may be made by means of a chart they submitted.

R. B. MOORE gave a brief account on recent developments in the extraction of helium from natural gas. His talk particularly had to do with repurifying the helium after its use in the dirigible when it had become diluted with air. The helium is freed from the air by passing the mixture through activated carbon at low temperatures. Air is absorbed but not the helium.

THOMAS T. GRAY and M. R. MANDLEBAUM gave a paper on the "Catalytic Treatment of Pressure Distillates in the Vapour Phase." By their method cracked vapours are passed through fuller's earth whereby, according to them, losses encountered when sulphuric acid is used for treatment are largely avoided. On passing through the fuller's earth the vapours polymerise into higher hydrocarbons to an extent and can be separated from the body of the distillate by virtue of the difference in boiling points. The loss due to the formation of these polymers only amounts to from 0·1 to 0·5 per cent. of the distillate. They state that it is possible with an adsorbent catalyst to produce satisfactory gasolines and burning oils from pressure distillates without acid treatment, but in the case of high sulphur oils a subsequent doctor treatment or alkali wash is usually necessary.

W. P. YANT, of the Bureau of Mines, gave a paper in which he showed the dangers of running automobiles in closed garages due to possible poisoning from carbon monoxide. His results show that the average automobile will create an atmosphere containing 0·5 to 0·7 per cent. of carbon monoxide in but eight to ten minutes of operation in a closed garage of 1500 cubic feet capacity.

N. E. FUNK, secretary of the lubricating committee of the National Electric Lamp Association, led a symposium on turbine oils. Mr. Funk's committee had made a great many tests on turbine oils extending over a long period of time, and his remarks were instructive in showing the Petroleum Division what was required of turbine oils and difficulties encountered with some of them.

B. T. BROOKS, of New York City, read a paper by A. E. Dunstan on the "Hypochlorite Method of Refining Light Petroleum Distillates." With this method chlorite or sodium hypochlorite is used in place of the ordinary sulphuric acid method. It was reported that the method is being used on a large and commercial scale and gives satisfactory results.

The meeting closed with a request on the Chairman's part for important papers for the fall meeting at Ithaca, New York, and a plea for as large an attendance, if not larger, than at the Washington meeting.

Abstracts

by E. H. McClelland, Carnegie Library, Pittsburgh, Pa.*

Duque, Don Refino.—El petroleo, Madrid.

"This is an exceedingly interesting work—the first on oil ever written in Spanish—and in one volume deals with the origin, history, and general progress of the world's petroleum industry."—*Petroleum Times*, Jan. 26, 1924.

Jakosky, J. J.—Uses of water in the oil-shale industry with particular reference to engineering requirements. 57 Pages, 1923.

Includes brief bibliography, and has a chapter on "Sanitation of oil-shale Camps," by A. L. Murray.

Alcohol and Benzol in Blended Motor Fuels.—*Petroleum Times*, **11**, Jan. 5, 1924, p. 6.

Brief account of research by U.S. Navy Department.

Baker, Ralph T.—New uses for cement in oil storage; rapidly increasing consumption of material in field work, refinery, buildings and for crude and refined reservoirs. *Oil and Gas Journal*, Jan. 24, 1924, p. 36, 86–88.

Reviews extent of concrete construction, and discusses requirements of concrete and reinforced concrete for various purposes, considering both safety and permanence.

Bell, H. S.—Controlling volumes and temperatures in refining operations. *National Petroleum News*, **16**, Feb. 20, 1924, p. 71–74.

Discusses instruments necessary in refinery, technology and power-plant control, and emphasizes importance of careful maintenance of instruments.

Bell, H. S.—The use of measuring instruments in oil refining. *National Petroleum News*, **16**, Jan. 9, 1924. pp. 39, 41, 43.

Mentions the more important instruments for measuring and recording temperature and volume, and discusses them very briefly.

Blummer Process for Obtaining Benzine and Lubricants.—*Petroleum Times*, **11**, Jan. 19, 1924, p. 82.

Based on article in *Petroleum*, Dec. 20, 1923. Claims that, starting with crude petroleum or gas oil, the conversion into benzene is round 70 per cent. of the material treated.

Coal the Source of our Future Oil Supplies.—*Petroleum Times*, **11**, Feb. 2, 1924, pp. 155, 156.

Description and Cost of Charcoal Process Plants.—*Oil Trade Journal*, **14**, Nov., 1923, p. 70.

Briefly quotes Burrell's description of plant used in Pennsylvania and West Virginia for extraction of gasoline from natural gas.

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* From the Monthly Bulletin of the Petroleum Division of the American Chemical Society April, 1924.

DOHERTY GET PATENT ON RADICALLY NEW REFINING METHOD.—*National Petroleum News*, **16**, Jan. 23, 1924, pp. 37–38–41–43.

Lengthy discussion of invention covered by U.S. patent 1,472,116 to Henry L. Doherty, "Not only a method of cracking but a system that is designed for tapping crude oil as well." Principal feature is an adaptation of the bubble tower, used in the alcohol industry, and heretofore used in the oil industry only as a fractionating tower.

EFFECT OF TIME ON OIL SAMPLES IN BOTTLES.—*National Petroleum News*, **16**, Jan. 2, 1924, pp. 42–43.

Field Museum of National History, Chicago, has samples more than 30 years old. Original display of Standard Oil Co., has been supplemented by U.S. Geological Survey. Other exhibits include oil sands, lubricants and other petroleum products, and a model of the first refinery erected by Rockefeller in 1863.

HINTZE, THOMAS F.—The possibilities of oil gas. *Oil Trade Journal*, **14**, Dec. 1923, pp. 74–76.

Describes Burke-Hintze Apparatus for utilization of low-grade crudes. Especially applicable to isolated industries. Diagrams.

KOONTZ, F. B.—Crude Oil and its yields at the refinery. *Oil Trade Journal*, **15**, Jan. 1924, pp. 35–36.

MCKEE, R. W.—Oil refinery costs and accounts. *Journal of Accountancy*, **36**, Oct. 1923, pp. 247–267.

May be of interest to the chemist, for the detailed classification of costs and the typical examples. For the accountant, the terminology and the processes are explained by means of a diagram of a complete refinery.

NEW FACTS RELATING TO THE BERGIUS PROCESS. *Petroleum Times*, **11**, Jan. 19, 1924, p. 100.
From *Bulletin de la Societe Chimique Belge*.

PETROL PRODUCTION BY THE CATALYTIC METHOD.—*Petroleum Times*, **11**, Jan. 5, 1924, p. 16.

Brief Account of Sabatier-Mailke process, from *La Revue Petrolifere*.

PRUTZMAN, PAUL W.—Chemical properties of California Petroleums. *Petroleum Times*, **11**, Jan. 12, 1924, pp. 51–52.

USE OF SOLID AGENTS IN REFINING MINERAL OILS.—*Petroleum Times*, **11**, Feb. 2, 1924, p. 168.

Mentions use of bauxite, bentonite. "A Colloidal Mineral or Rock," silica gel, and activated carbon.

Abstracts

from the

January Bibliography of the U.S. Bureau of Mines.*

Properties of Petroleum and Their Determination.

Boyschlag, F.—The relationships of the "Kupferschiefer." *Z. prakt. Geol*, 1921, 1-9. "The cu-formation of the Mansfield region is a sedimentary rock rich in bituminous matter and pyrite, and containing no primary Cu or Ag." See also *Chem. Abs.*, vol. 16, July 10, 1922, p. 2097.

Bibbins, A. B.—Comparative study of some Maryland gases. *Maryland Acad. Sci. Bull.*, vol. 1, 1922, pp. 47-48. Analysis of 12 gases from different locations. *Chem. Abs.*, vol. 16, Nov. 20, 1922, p. 4050.

Blair, E. W. and Wheeler, T. S.—An improved form of gas-analysis apparatus. *Jour. Soc. Chem. Ind.*, vol. 41, June 15, 1922, pp. 187T—188T. Description and cut of apparatus and details of its operation; an important feature of which is the use of compressed air and mercury to alter the mercury levels of apparatus.

Bomberg, M.—Colour of petroleum mixtures and paraffin wax. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 361-363. "The colour value (Stammer) of petroleum mixtures may be computed with tolerable accuracy from respective colour values, the sum of these giving the reciprocal of the colour value of the mixture." See also *Jour. Soc. Chem. Ind.*, vol. 41, May 15, 1922, p. 319A.

Bousu, R. G.—Limit of inflammability of the vapours of the alcohol-petrol and of a ternary system with a basis of alcohol and petrol. *Comptes rend.*, vol. 175, 1922, pp. 30-32. Le Chatelier and Boudouard method is used in a study of the variation of the lower limit of inflammability of the binary system alcohol-petrol and of the ternary system petrol-alcohol-ether. See also *Jour. Soc. Chem. Ind.*, vol. 41, Aug. 15, 1922, p. 578A.

Burrell, G. A.—Ethyl gas. *Nat. Gas*, vol. 4, Dec. 1923, p. 9. Properties of ethyl gas, an anti-knock compound for gasoline.

Chemical and Metallurgical Engineering.—Asphalt specification recommended. Vol. 29, Dec. 31, 1923, p. 1189. Recommendations of Bureau of Standards for construction of asphalt pavements, for surface treatment and penetration limits.

Chemiker-Zeitung.—New apparatus for the examination of the softening point of paraffins, waxes, resins, pitch, asphalt and the like. *Jahrg.* 46, 1922, p. 386. *Jour. Soc. Chem. Ind.*, vol. 41, June 15, 1922, p. 443A. Description of apparatus and method of operation.

Chemiker-Zeitung.—Apparatus for determining the volatility, blistering and adhesion of asphalt on metal, by J. W. H. Uytenbogaart, Jr., *Jahrg.* 46, 1922, pp. 565–566. "The apparatus consists essentially of

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* From the Monthly Bulletin of the Petroleum Division of the American Chemical Society, April, 1924.

a naphthalene bath by which the asphalt is heated in a porcelain crucible to determine the volatility. . . ." Illustration. *Chem. Abs.*, vol. 16, Sept. 10, 1922, p. 2797.

CHEMIKER-ZEITUNG.—New apparatus for investigating paraffins, waxes, resins, pitches, asphalts. *Jahrg.* 46, 1922, p. 386. Description of Nashan's "Malakograph used for the determination of the rate of softening waxes and similar substances." See also *Chem. Abs.*, vol. 16, Aug. 20, 1922, p. 2624.

CLOUGH, W. W., and JOHNS, C. O.—Alcohol from crude oil. *Petroleum Age*, vol. 13, Jan. 1, 1924, pp. 48, 50, 59. Information regarding process whereby alkyl acid esters are formed from which various alcohols are obtained.

DELBRIDGE, T. G.—Improvements in apparatus for testing petroleum products. *Proc. Am. Soc. Testing Materials*, 21, 1921, pp. 1100–1110. Description of apparatus for taking Baume gravities, gravity temperature corrector, special gas burner, distillation apparatus for naphtha, assembly of Saybolt Universal viscosimeters, paraffin-wax melting-point recorder, Cleveland open-cup flash-tester, for use with small samples of oil, and the Altrood viscosimeter.

DUTROIT, A. L.—Oil shale in South Africa. *South African Jour. Ind.*, 1921, p. 346; *Bull. Imp. Inst.*, vol. 19, 1921, pp. 417–418. Natoil shale is a variety of coal, similar in some respects to cannel. Oil yield varied from 12–28% gals. per ton.

ECKART, HANNS.—Several products which may be added to liquid motor fuels. *Brennstoff-Chem.*, bd. 4, 1923, pp. 134–136. Compounds which added to motor fuel increase the velocity and ensure complete combustion. See also *Chem. Abs.*, vol. 17, Nov. 29, 1923, p. 3770.

FRANCIS, F., POPE, J. C., and COYSH, R. H.—Composition of paraffin wax. *Chem. Soc. Trans.*, vol. 121, 1922, pp. 496–513. Theory concerning the reactions produced by treatment of paraffin with a small amount of turpentine in the presence of heated air or oxygen. See also *Jour. Soc. Chem. Ind.*, vol. 41, May 31, 1922, p. 360A.

FRANCIS, F., WATKINS, C. M., and WALLINGTON, R. W.—*Chem. Soc., Trans.*, vol. 121, 1922, pp. 1529–1535. *Jour. Soc. Chem. Ind.*, vol. 41, Oct. 31, 1922, p. 800A. Tests made with a paraffin of Scotch origin, fractionatep twenty-one times and boiling range of material obtained was 170°–230° C. to 125°–280° C. Conclusion that practically 80% of paraffin is composed of seven substances of a constant boiling point; the remaining amount consists of products boiling at 220°–240° C. The nature of the constant boiling fractions is not definitely determined.

FRISSO, R. M.—Dielectric (breakdown) value of insulating oils. *Wiss. Voroffentl. Siomons-Kenzern*, 1921. *Jahrg*, 1, pp. 41–45. *Chem. Zentr.*, 1921, *Jahrg.* 4, 92, p. 1349. "Insulating oil, prepared by the purification and fractional distillation of petroleum oil, has when perfectly dry a maximum dielectric (breakdown) value of 230 kilovolts per com., but this is considerably reduced by absorption of moisture from the surrounding air, *e.g.*, in free contact with air of about 50–50% relative humidity, the value is reduced to about 50 kilovolts per cm." See also *Jour. Soc. Chem. Ind.*, vol. 41, Feb. 28, 1922, p. 147A.

FULWEILER, W. H.—Report of the technical Committee on gas oil. *Tech. Soc. Am. Gas Assoc., 3rd Annual Convention*, vol. 3, 1921, pp. 9–38. Data on production, tests and analyses.

GAULT, H., and BOISSELOT, L.—The presence of carbon monoxide in the natural gas from Pechelbronn (France). *Mat. Grasses*, vol. 14, 1922, pp. 6058-6060. Analysis of natural gas from Russia, Austria, France and from some States in United States reveals CO, and it probably exists to some extent in all natural gas. Pechelbronn gas contained CO_2 O_2, CO as a possible indication of petroleum origin.

GAVIN, M. J., and AYDOLOTTO, J. T.—Solubility of oil shales in solvents for petroleum. *Bureau of Mines of Investigations, No.* 2313, 1922, 3pp. Investigation of statement that oil shales contain no oil, but that oil is produced from organic material by distillation. Ground shale was treated with various solvents, the largest yields extracted were with Mo_2CO and $ChCl_3$; this yield is no indication of distillation yield.

GLASOR, K.—Apparatus for determining resistance to cold of mineral oils. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 81–82. Description of an apparatus designed to test oil at freezing temperatures. See also *Chem. Abs.*, vol. 16, Sept. 20, 1922, p. 3199.

HONTZO, E.—Attempted isolation of bitumen in its original form from bituminous rocks. *Zuschr. angew. Chem., Jahrg.* 55, 1922, pp. 330–331. Tests were made with green kieselguhr and Esthonian shale or Kukkersite by dissolving the rock from the bitumen. Isolated bitumens had less volatile products, but a greater quantity of light-boiling products in the tar were higher than in the isolated bitumens.

HOFF, F. A.—Making of cup and transmission grease. *Oil News*, vol. 11, Dec., 1923, p. 17. Formulas for different grades of cup grease and transmission grease.

HOLDE, D.—Capillary properties of mineral oils. *Chem.-Zeit., Jahrg.* 46, 1922, pp. 3–4. "The surface tension against air of the most varied kinds of petroleum lubricating oils, as measured by the drop-weight method, ranges from 3·10 to 3·14 abs. units." Fatty oils vary from 3.18 to 3.32. Anthracene oil has a higher value (4.37). Texas and Russian lubricating oils have lower values, 3.00 to 3.07. "Discussion of relation between surface tension and lubricating value."

HOLDE, D.—Some practices in mineral oil testing. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 853-858. Data on investigations made with Frey's Aniline test for determination of petroleum. Description of Conradson emulsion test. Changes in bulks and connecting tubes of the Engler viscosimeter. *Chem. Abs.*, vol. 16, Nov. 20, 1922, p. 4054.

INOUYO, MASAKADU.—Preparation of petroleum from fatty oils. *Jour. Chem. Soc. Japan*, vol. 42, 1921, pp. 1065–1072. Fatty acids are changed to kotones and decomposed to petroleum; results obtained with sardine oil. See *Chem. Abs.*, vol. 16, June 20, 1922, p. 2025.

JAHN, J. J., and SCHNABOL, E.—The naphtha-bearing terrains of Turkzovkam in the White Carpathians. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 441–447. Physical and chemical properties of crude samples. Oil was of Pennsylvania type as it had no asphalt, very little sulphur and a paraffin base. See also *Chem. Abs.*, vol. 16, Sept. 20, 1922, pp. 2199–3200.

JAKES, M.—Precipitation of the asphaltenes from mineral oils by cyclohexane. *Chem.-Zeit.*, bd. 47, 1923, pp. 757–758. More satisfactory results were obtained with technical and carefully refined cyclohexane than with benzine. See also *Jour. Soc. Chem. Ind.*, vol. 42, Nov. 6, 1923, p. 1059A.

JOURNAL SOCIETY CHEMICAL INDUSTRY.—Interim Report of the Engineering Committee of the Empire Motor Fuels Committee, vol. 41, May 31, 1922, pp. 223B. Review of report on tests made on alcohol by Ricardo. Results showed that alcohol could be used in all exist-types of volatile fuel engine, and in especially designed high-compression engines, and in all cases the thermal efficiency is greater than with hydrocarbon fuels. Cylinder was more easily kept cool than with hydrocarbon; no corrosion; heat supplied the carburettor reduced the power-output somewhat, but the thermal efficiency was slightly increased.

KALETA, T.—Estimation of boring and cooling oils (soluble oils). *Chem.-Zeit., Jahrg.* 46, 1922, pp. 783–784. Procedure for the estimation of soap, mineral oil and fatty oil. *Jour. Soc. Chem. Ind.*, vol. 41, Oct. 31, 1922, p. 800A.

KATTWINKEL, R. A.—New apparatus suitable for the determination of organic vapours (benzene, benzine) in gases by the use of activated carbon. *Brennstoff-Chem.*, bd. 4, 1923, pp. 179–180. Gas is passed through cylinder containing activated carbon, after absorption steam is injected and absorbed vapours are driven into a water-cooled condenser and condensate is caught in a graduated receiver. See also *Chem. Abs.*, vol. 17, Nov. 20, 1923, p. 3630.

KAUFFMAN, H. L.—The manufacture of cup and transmission greases. *Oil and Gas News*, vol. 13, Dec. 17, 1923, pp. 12, 14. Characteristics of transmission greases; methods of manufacture.

KAWAI, S.—Iodine values of petroleum oils. *Jour. Chem. Ind.* (Japs.), 1922, vol. 25, 406–419. *Jour. Soc. Chem. Ind.*, vol. 41, July 31, 1922, p. 535A. Effects of concentration, temperature, and time of absorption are noted.

KING, J. G.—Analysis of mixtures of hydrogen with the paraffin hydro-carbon. *Fuel*, vol. 1, 1922, pp. 103–106. *Jour. Soc. Chem. Ind.*, vol. 41, July 31, 1922, pp. 533A–534A. Method for removal of carbon dioxide and oxygen; after this is done the paraffins are exploded with excess air and absorbed by potash and by alkaline pyrogallol the reductions resulting therefrom are noted and volume of hydrocarbons can be calculated.

KNUTSON, BERTIL.—Lubricants for internal-combustion engines. *Toknisk Tids*, 53, *Kemi*, 1923, pp. 49–51. Characteristics necessary in automobile lubricants and tests for determination of these characteristics.

KOETSCHAU, R.—Ozonides from petroleum. *Ztschr. Angew. Chem., Jahrg.* 35, 1922, pp. 509–513. *Jour. Soc. Chem. Ind.*, vol. 41, Nov. 15, 1922, p. 84. Data on experiments to determine the action of ozone on American petroleum oils; results of ozonising a Russian petroleum are discussed.

MARCUSSON, J., and SMELKUS, H.—The colouring constituents of Montan wax. *Chem. Zeit., Jahrg.* 46, 1922, pp. 701–702. Physical and chemical characteristics of the other soluble constituents and the hydroxy acids of Montan wax. See also *Jour. Soc. Chem. Ind.*, vol. 41, Sept. 15, 1922, p. 659A.

MARILLER.—The "national" motor fuel; its actual status and industrial preparation. *Bull. Assoc. Chim. sucr. dist.*, vol. 39, 1921, pp. 215–231. World's production of petroleum and its consumption in France; proposed fuel composition to be of combustibles produced in France in their relative proportions combined with imported gasoline; methods of dehydration of alcohol. See also *Chem. Abs.*, vol. 16, July 20, 1922, p. 2399.

MARINOT, A.—Determination of water in fuel oils. *Ann. Chim. Anal. Chim. App.*, vol. 4, 1922, pp. 7–8. Sample of oil is placed in two weighed flasks, which are placed in a bath of boiling distilled water; dry H current is passed through oil, causing gas to pass into a tube of lower temperature, where anthracene is condensed and then into a weighed $CaCl_2$ tube after oil is sufficiently dried the flasks and $CaCl_2$ tube are weighed and loss in weight of oil should equal gain in weight of tube.

MAYNE, R.—Palm oil motors. *Ann. Gembloux*, vol. 26, No. 11, 1920, pp. 509–515. Analysis of palm oil show that the m.p. is from 37–48 (98·6 to 118·4 F.) so that it is suitable for use as fuel only in torrid climates, unless provision is made for preheating. See also *Chem. Abs.*, vol. 16, Sept. 20, 1922, pp. 3192–3193.

MIDGLEY, THOMAS, JR.—"Knock" in motor, how it is caused and its prevention. *Oil and Gas Jour.*, vol. 23, Dec. 20, 1923, p. 23. Presented before the American Petroleum Institute, St. Louis, Mo. Mechanical checking of detonation would decrease power output of each explosion, but addition of oil known as totra othyl lead prevents knocking.

MORFUGO, GIULIO.—Indirect determination of the calorific value of naphtha used as a fuel. *Giorn. Chim. Ind. Applicata*, vol. 4, 1921, pp. 15–17. Procedure for analysis of liquid fuel. See also *Chem. Abs.*, vol. 16, Aug. 10, 1922, p. 2589.

MULLER, A.—The viscose-stalagmometer. *Deut. Parafum. Ztg., Jahrg.* 7, 1921, pp. 175–178; *Chimie et Industrie*, vol. 7, 1922, p. 285. A pipette with two graduation marks and a three-way cock just below the lower mark, by means of which the liquid can be drawn up is surrounded by a water-jacket having a stirrer and thermometer; the liquid in the pipette is allowed to reach the temperature of the jacket. The time taken by liquid to flow from one mark to another and the number of drops is compared with same results for pure water.

MZOUREK, J.—Asphaltic substances in lignite producer tar. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 77–81. Method followed in treatment of tar; nature of products obtained. *Chem. Abs.*, vol. 16, Sept. 20, 1922, p. 3201.

NARBUTT, J.—The isolation of organic substances in Esthonian oil shales. *Ztschr. angew. Chem. Jahrg.* 35, 1922, pp. 238–239. Method of obtaining sample of organic matter and description of its properties. See also *Chem. Abs.*, vol. 16, Aug. 10, 1922, p. 2598; See *Chem. Ind.*, vol. 41, June 30, 1922, p. 452A.

NATIONAL PETROLEUM NEWS.—Tentative Method of test for colour of lubricating oils by means of Union Colourimeter. Vol. 15, 1923, p. 45.

ODA, KEIJI.—Hydrogenation of acetylene for the preparation of fuel oils, *Jour. Chem. Ind.* (Japan), vol. 24, 1921, pp. 1161-1166. A mixture of equal amounts of C_2H_2 and H_2 was passed over a catylizer of Ni with

Hg at 25–35, 51·7% of the theoretical yield of oil was obtained; a light oil and a heavy oil were obtained from the gas of the mixture. See also *Chem. Abs.*, vol. 16, July 20, 1922, p. 2399.

ORMANDY, W. R. and CRAVEN, E. C.—Physico-chemical significance of flash-point temperatures. *Chem. Trade Jour.*, vol. 70, 1922, pp. 41–42. Description of a new form flash point apparatus. "Application of results to explosive limits in the carburetion of internal-combustion engines are discussed."

PARR, S. W.—Analysis of fuel, gas, water and lubricants. McGraw-Hill Book Co., Inc., 370 7th Ave., New York. 250 pp. third edition, revised and enlarged. Discussion of fuel problems in the Mid-Continent section as well as eastern part of country; laboratory methods.

PAYMAN, W., and WHEELER, R. V.—Combustion of complex gaseous mixtures. *Chem. Soc. Trans.*, vol. 121, 1922, pp. 363–379. "The speed of propagation of flame in the limit mixtures of each of the paraffin hydrocarbons with air is the same under standard conditions, and in general if the limit mixture of one gas with air be mixed in any proportion with the limit mixture of the same type of another gas with air the speed of propagation of flame in the resulting complex mixture is unchanged."

PETROLEUM TIMES.—Standardization of motor fuels. Vol. 10, Dec. 22, 1923, p. 892. Consideration of characteristics and properties desirable for standardisation.

PETROLEUM WORLD (Los Angeles).—The determination of viscosity. Vol. 8. Nov., 1923, pp. 62, 64. Description of pocket viscosimeter.

PETROLEUM ZEITSCHRIFT.—Technical specifications for transformer and switch oils. *Jahrg.* 19, 1923, pp. 838–849. Specifications and tests as set forth by the *Vereinigung der Elektrizitatswerke.*

PREDESCU, C.—A study of the illuminating power of Roumanian kerosene *Bulletin Sec. sci. acad. Roumanie*, vol. 7, 1921, pp. 49–73. Data on photometric and spectrophotometric experiments. See also *Chem. Abs.*, vol. 16, June 10, 1922, pp. 1860–1861.

PYHALA, E.—Examination of paraffin wax and vaseline. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 1164–1165. Method consists of dropping melted sample from glass rod into warm alcohol to which water is added until solution is of same specific gravity of alcohol water solution is determined. *Jour. Soc. Chem. Ind.*, vol. 41, Oct. 31, 1922, p. 800A.

RAKUSIN, M. A.—Probability of reaction between sulphur and solid paraffins in oil-bearing strata. *Petroleum Ztschr., Jahrg*, 18, 1922, pp. 581–582. *Jour. Soc. Chem. Ind.*, vol. 41, July 15, 1922, pp. 492A–493A.

RAKUSIN, M. A.—The probability of reaction between sulphur and solid paraffin in the mineral oil-bearing regions. *Petroleum Ztschr., Jahrg*, 18, 1922, pp. 581–582. Description of laboratory test from the results of which it was concluded that in petroleum deposits containing paraffin and in those free of paraffin the sulphur content in the latter would be smaller. *Chem. Abs.*, vol. 16, Sept. 20, 1922, p. 3200.

REILLY, J., and BLAIR, E. W.—The thermal decomposition of petroleum residues at reduced pressures. *Jour. Soc. Chem. Ind.*, vol. 41, Sept. 15, 1922, pp. 302T–303T. Data on dry distillation and investigation of petrolatum.

SCHRAUTH, W., and VON KEUSSLER, O.—The dracorubin test of hydrogenated compounds. *Auto-Technik, Jahrg.*, 10, 1921, No. 17, pp. 3–4. Tests show that saturated hydrocarbons show benzine (petroleum spirit) characteristics and hydrogenated phenols the alc. characteristics, while unsaturated hydrocarbons show unchanged benzene characteristics; these results are confirmed by use of products as motor fuel. See also *Chem. Abs.*, vol. 16, Sept. 10, 1922, pp. 2984.

SCHULTZ F.—Analysis of Czechoslovakian petroleum. *Petroleum Ztschr. Jahrg.* 18, 1922, pp. 321–323. Comparison of Gbely oil with certain types of Louisiana oils; characteristics; similarity of Bohuslavico, Turzovka, and Mikova oils; characteristics, similarity of Bohuslavico Turzovka, and Mikova oils to Pennsylvania petroleum. See also *Chem. Abs.*, vol. 16, Sept. 20, 1922, p. 3199.

SCHWARZ, P.—Detection of benzene in benzine. *Chem.-Ztg., Jahrg.* 46, 1922, p. 401. Benzine is added to aniline and EtOh and if C_6H_6 is present $PhNH_2$ is formed. See also *Chem. Abs.*, vol. 16, July 20, 1922, p. 2403; *Jour. Soc. Chem. Ind.*, vol. 41, July 15, 1922, p. 493A.

SCHWARZ, F. and MARCUSSON, J.—Determination of the tar number of transformer and turbine oils. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 741–742. Description of procedure in testing oils. *Chem. Abs.*, vol. 16, Nov. 20, 1922, p. 4055.

SEYER, W. F.—Oiliness of lubricating properties of the various series of hydrocarbons. *Trans. Roy. Soc.*, Canada, vol. 15, 1921, iii., 69–71. Data on lubricating properties of the saturated and unsaturated constituents of an oil distilled from a California asphalt base petroleum. *Jour. Soc. Chem. Ind.*, vol. 41, May 31, 1922, p. 360A.

SIEBENOCK, H.—Oxidation of paraffin wax. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 1193–1196. *Jour. Soc. Chem. Ind.*, vol. 41, Nov. 30, 1922, p. 388A. Description of method and products.

SMOLENSKI, K., TUROWICZ, S., and DOBROWESKI, R.—Cracking petroleum. *Przomysl Chem.*, vol. 5, 1921, pp. 201–220, 237–254. Krosno petroleum yields aromatic hydrocarbons similar in amounts to Baku petroleum; quality of products depends largely upon temperature of distillation. See also *Chem. Abs.*, vol. 16, Sept. 10, 1922, p. 2984; *Jour. Soc. Chem. Ind.*, vol. 41, June 15, 1922, p. 402A.

TOR MOULON, H.—Determination of sulphur in organic compounds, also in some technical products, petroleum oils, coal, illuminating gas and rubber. *Rec. Trav. Chim.*, vol. 41, 1922, pp. 112–120. "The organic substance containing sulphur (20 mg.) is heated in a stream of hydrogen until completely volatilised or decomposed. The gas stream is led over platinised asbestos, which converts all the sulphur into hydrogen sulphide. The latter is absorbed in alkali and estimated either volumetrically by means of iodine or, if the amount is small, colourimetrically with sodium plumbite." See also *Jour. Soc. Chem. Ind.*, vol. 41, March 31, 1922, p. 235A.

TROPSCH, H., and FREUTZER, A.—The acids of montan wax. *Brennstoff-Chem., Bd.* 3, 1922, pp. 177–180, 193–198, 212–215. Treatment of lignite with benzene or benzene-Alcohol mixtures produced a crude acid, which was esterified and distilled; the acid isolated was treated and produced montanic acid. See also *Jour. Soc. Chem. Ind.*, vol. 41, Sept. 15, 1922, p. 659A.

TROPSCH, H. and PHILIPPOVICH, A. V.—Estimation of ethylene and its homologs in primary gas. *Brennstoff Chem.*, *Bd.* 4, 1923, pp. 147–149. Methods for determination of propylene and its homologs, ethylene, and the naphthenes.

U.S. BUREAU OF STANDARDS (Volumetric Section).—Conversion tables for petroleum. Letter Circular 89 (mim.).

U.S. BUREAU OF STANDARDS—Letter Circular 101. Petroleum tables. See also Tech. Paper 77 and Circular 77.

UTZ. PETROLEUM.—Refractometric examination of petroleum and petroleum products. *Jahrg.* 17, 1921, pp. 1293–1299. "A comprehensive review of past work on the refractive indices of petroleum products." See also *Jour. Soc. Chem. Ind.*, vol. 41, Jan. 16, 1922, p. 2A.

WATERMAN, H. I., and PORQUIN, J. N. J.—Determination of aromatic hydrocarbons in fractions of mineral oils. *Rec. Trav. Chim.*, vol. 41, 1922, pp. 192–198. "The 'aniline point' method," described by Tizard and Marshall (*J.*, 1921, 20T), which consists in noting the temperature at which a mixture of equal volumes of aniline and hydrocarbon separates before and after treatment of the latter with 98% sulphuric acid, is considerably affected by the nature of the fraction dealt with. Results of trials gave results which were inaccurate when checked with amount of added aromatic hydrocarbons. *Jour. Soc. Chem. Ind.*, vol. 41, April 20, 1922, pp. 282A.

WHEELER, T. S., and BLAIR, E. W.—The oxidation of hydrocarbons, with special reference to the production of formaldehyde. Part V. The slow oxidation of the higher liquid, saturated hydrocarbons. *Jour. Soc. Chem. Ind.*, vol. 42, Dec. 21, 1923, pp. 491T–497T. Review of results of previous experiments; methods; summary and conclusions.

ZELINSKY, N. D.—Catalytic decomposition of petroleum oils under the influence of aluminum chloride. *Techn.-Wirtschaftl, Nachr.*, 1922, pp. 193–197. *Chem. Zentr.*, 94, IV., 1923, p. 476. Attempt was made to prepare artificial petrol from heavy petroleum oils by heating in presence of charcoal results. See also *Jour. Soc. Chem. Ind.*, vol. 42, Oct. 26, 1923, p. 1010A.

ZELINSKY, N.—Behaviour of naphthenes towards catalytic dehydrogenation. The nature of petroleum. *Ber.*, vol. 56, 1923, pp. 1718–1725. "Octanaphthene, iso-octanaphthene, and nona-naphthene undergo very slight dehydrogenation in the presence of platinum or palladium black at 300°–310° C. It therefore appears that the natural naphthenes of petroleum consist mainly of cyclic compounds other than hexahydroaromatic hydrocarbons."

REFINING AND REFINERIES.

BURRELL, G. A.—The manufacture of petroleum products. *Oil and Gas Jour.*, vol. 20, No. 50, 1922, pp. 14, 115–121. Discussion of various cracking processes. Yields of products from several crudes by the various processes.

BURTIN, W. M.—Origin of the petroleum "cracking" process. *Jour. Soc. Chem. Ind.*, vol. 41, Feb. 15, 1922, pp. 50R–52R. Address delivered

by the recipient of the Perkin Medal at the American Section, Chem. Soc. Review of problems and progress in the development of fuel for the internal combustion engine.

CANADIAN CHEMISTRY AND METALLURGY.—Carbon black, industrial hydrogen and motor fuels discussed by Shawinigan Section. Vol. 7, Dec., 1923, p. 314. Brief review of paper read by S. A. Wisdom before Shawinigan Falls Section of Society of Chemical industry, Oct. 15, 1923. Because of patent situation, the manufacture of carbon black from acetylene could not be described, but its production from natural gas in a plant of low cost was described; plant may be dismantled and moved to another location. Carbon black is excellent filler in manufacture of rubber as it prolongs the wear in addition to being a diluent.

CANTIENY, G.—New methods of improving coal. *Umschau*, vol. 26, 1922, pp. 33–36. Method of low-temperature carbonization and the hydrogenation of petroleum.

COSTER VAN VOORHOUT, A. W.—The recovery of sulphuric acid from waste sulphuric acid of the petroleum factories. *Chem. Weekblad, Jahrg.* 19, 1922, pp. 115–117. "The tarry viscous mass containing H_2SO_4 obtained in refining petroleum is diluted with H_2O warmed and then put into an autoclave containing CO_2 under pressure; this is then heated to give a total pressure of about 6–7 atm. After a while two layers separate from which the H_2SO_4 can readily be obtained." Description of procedure in an experiment. See also *Chem. Abs.*, vol. 16, June 20, 1922, p. 2025.

DEAN, E. W., and JACOBS, W. A.—Production of gasoline by cracking heavier oils. *Bureau of Mines*, technical paper 258, 1922, 56 pp. pamphlet. Report on methods and equipment used in tests; effects of temperature and pressure; control of carbon formation factors affecting quality and volume of cracked gasoline.

EGLOFF, GUSTAV.—Kentucky oil has big gasoline content. *Oil and Gas Jour.*, vol. 23, Nov. 29, 1923, pp. 76, 124–126. Dubbs process has produced large yield of gasoline when heretofore low coke forming oils were obtained; cracking system and apparatus; method; products and their properties.

ELLIS, O., and MEIGS, J. V.—Gasoline and other motor fuels. D. van Nostrand Co., New York. Survey of motor fuel industry. Contains detailed specifications of patents and processes; description of testing methods for motor fuels.

FOSTER, D. E.—Compression and oil absorption plants. *Oil and Gas Jour.*, vol. 23, Dec. 27, 1923, pp. 76–77, 92, 94. Advantages of converting a compression plant into an absorption plant are more and better gasoline, treatment of lean gases that cannot be treated by compression, and less cost of operation.

HOLDE, D., and WEILL, S.—Aniline as an analytical reagent in fuel chemistry. *Bronnstoff-Chem., Bd.* 4, 1923, pp. 177–179. Excellent results have been obtained in the use of aniline for separation of tar oils from mineral oils.

HOUSTON, H. M., and O'CONNOR, J. B.—Residue from casinghead gas once wasted now revenue source. *Oil and Gas Jour.*, vol. 23, Jan. 3, 1924, pp. 36, 92. Where commercial quantities of residue gas are available and pipe-line systems exist gas is disposed of to municipal and industrial consumers.

JOURNAL SOCIETY OF CHEMICAL INDUSTRY.—Technical aspects of hydrogenation, vol. 41, Sept. 30, 1922, pp. 384R–387R. Discussion of the effects of hydrogenation and methods of producing hydrogenation; possibilities of poison. Explanation of the catalyst use and reactions.

JOURNAL SOCIETY OF CHEMICAL INDUSTRY.—Emulsions in technical practice. Vol. 41, Aug. 31, 1922, pp. 346R–348R. Production of stable emulsions; breaking of emulsions as applied in petroleum industry.

KOONTZ, F. B. — Crude oil and its yields at the refinery. *Oil Trade Jour.*, vol. 15, Jan., 1924, pp. 35–36. Description of distillation methods and the treatment of distillates. Proper crude oil is an important factor in successful operation of a refinery and should be selected in accordance with equipment.

LESLIE, E. H.—Ideal continuous distillation. *Oil News*, vol. 11, Dec. 1923, pp. 15–16. Discussion of features which an ideal distillation apparatus should possess; equations applicable to ideal distillation process.

MATTHIS, A. R.—Determination of volatility of oils. *Bulletin Fed. Ind. Chim. Belg.*, vol. 1, 1922, pp. 397–405. *Jour. Soc. Chem. Ind.*, vol. 41, Sept. 30, 1922, pp. 699A–700A. "In addition to the quantity of oil used for the test and the temperature and duration of heating, the area of exposed surface and the projection of the vessel above the surface of the oil should be taken into account as these have a definite bearing on the rate of evaporation."

MCKEE, R. H.—Gasoline from oil shale. *Chem Age* (New York), vol. 30, 1922, pp. 1–4. Potential production of oil from Green River shales in Colorado, Utah, and Nevada in known deposits is eight times the total oil well production in United States. Distilling methods and characteristics of products.

MILLER, E. B.—Use of silica gel in petroleum refining. *Oil and Gas Jour.*, vol. 23, Dec. 20, 1923, pp. 104, 106, 108, 151, 158, 159. Properties and and process of manufacturing silica gel; increased gasoline yield and decreased distillate yield is possible through removal of high boiling sulphur compounds. Diagram and flow sheet for oil refining plant.

NOBLE, H. R.—Blending natural gasoline. *Petroleum Age*, vol. 13, Jan. 1, 1924, p. 52. Various methods of mixing natural gasoline with straight-run gasoline.

OBERFELL, G. G., and ALDEN, R. C.—The uses and limitations of charcoal process plants. *Nat. Gas*, vol. 4, Dec., 1923, pp. 14–16, 69–70. Data presented show increased production over the other methods, possible with use of charcoal.

PETROLEUM TIMES.—Dehydration of oil by an electrical process. Vol. 10, Dec. 29, 1923, p. 920. Description of several types of apparatus designed for treatment of oil emulsions.

PETROLEUM TIMES.—The Edelanu oil-refining process. Vol. 10, Dec. 29, 1923, p. 916. Aromatic and unsaturated constituents of kerosene distillate of Roumanian and similar oils are removed by agitation with liquid sulphur dioxide in a closed system at low temperature.

PLATZMANN, C. R. A new centrifugal for separating solids from liquids. *Chem.-Ztg., Jahrg.* 47, 1923, pp. 167-168. Description of the Centrifugal Separators, Ltd., London, which combines features of the centrifugal and filter press, is economical in operation, and is capable of handling suspensions to which presses are not adapted.

RAKUSIN, M. A.—Die festen Paraffine des Erdols. *Petroleum Ztschr., Jahrg.* 18, Jan. 1, 1922, pp. 5–9; Jan. 10, pp. 42–48. Data on various methods employed for extraction of solid paraffins from Grosny petroleum; no method was entirely successful, but best results were obtained by centrifuging and by filtering residual oil with fuller's earth. See also *Jour. Soc. Chem. Ind.*, vol. 41, Feb. 28, 1922, p. 129A.

RAKUSIN, M. A.—The limit of absorptive power of floridin. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 797–798. Grosny paraffin-free oil was decolorized by standing 24 hours containing 5% of floridin. Data on further tests. *Chem. Abs.*, vol. 16, Nov. 20, 1922, p. 4054. *Jour. Soc. Chem. Ind.*, vol. 41, Aug. 15, 1922, p. 578A.

SCHNECKENBERG.—Compressed-air filters. *Chem. Ztg., Jahrg.* 46, 1922, p. 406. Air pressure is more economical than vacuum. *Chem. Abs.*, vol. 16, Aug. 20, 1922, p. 2624.

SIEBENECK, H.—The influence of the elements of the oxygen group on paraffin. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 281–286. Paraffin heated to 135° is treated by bubbling air and oxygen through it and results noted. See also *Chem. Abs.*, vol. 16, Sept. 20, 1922, p. 3200.

TRUESDELL, PAUL.—Making the refinery show a profit by reducing operating costs. *Nat. Petroleum News*, vol. 15, Dec. 29, 1923, pp. 23–24, 28. Advantage of pipe still; highest efficiency is obtained by having gases and oil as nearly as possible the same temperature, this is possible by bringing crude oil in contact with outgoing gases which have lost most of their heat. Economies possible with towers.

VON GROELING, A. E.—Recent processes for treatment of oil shale. *Petroleum Ztschr., Jahrg.* 18, 1922, pp. 487–493, 539–545. Review of Scottish and German methods of shale retorting; details of American digesting method of treating shale. See also *Chem. Abs.*, vol. 16, Nov. 20, 1922, pp. 4054–4055.

WELCH, L. C.—The manufacture of lubricating products from Wyoming and Colorado crude oils. *Proc. Colo. Sci. Soc.*, vol. 11, 1922, pp. 275–294. Detailed description of methods of treating oils to produce lubricating, automobile, cylinder oils and paraffin. See also *Chem. Abs.*, vol. 16, Nov. 20, 1922, pp. 4055–4056.

WILLIAMS, F. N.—Cylindrical stills and pipe stills compared. *Petroleum World* (London), vol. 21, Jan., 1924, pp. 31–33. Advantages of continuous stills; facts regarding pipe stills and their operation.

Current Bibliography

Compiled by W. J. Wilson, F.I.C., A.C.G.I.

1. Geological.

Immediate Need for Petroleum Research.—G. O. Smith. *Oil and Gas J.* **23**, (20), 60.

Application of Paleontology to Oil Development.—J. G. Hautier. *Oil Trade J.* **15**, (5), 54.

Estimation of the Petroleum Deposits of Czecho-Slovakia.—R. Kettner. *Petroleum* **20**, 187. *Chem. Abstr.* **18**, 1262.

Geology and Technic of the North American Helium Occurrences.—W. Kauenhowen. *Petroleum* **20**, 3. *Chem. Abstr.* **18**, 1263.

Gaseous Content of Ground Waters as an Aid to the Petroleum and Natural Gas Prospector.—G. W. Jones, W. P. Yant, and E. P. Buxton. *U.S. Bureau Mines Repts. Investigations* 2553. *Chem. Abstr.* **18**, 1381.

Petroleum Geology—Past and Present.—R. Arnold. *Bull. Amer Assoc. of Petr. Tech. Oil Engineering and Finance* **5**, 267. *Oil Weekly* **33**, (2); (3), 37.

Petroleum in Roumania. Additional Observations on the Petroleum Deposits of Roumania.—B. Yovanovitch. *Bull. Soc. Géol. France* [4], **22**, 11. *Chem. Abstr.* **18**, 1452.

Petroleum in Morocco. Observations on the (Petroleum) Carrying Beds of the Basin of the River Sebou, Morocco.—R. Abrard. *Bull. Soc. Géol. France* [4], **22**, 145. *Chem. Abstr.* **18**, 1452.

Petroleum in Morocco. The Geology of the Petroleum in Morocco.—B. Yovanovitch. *Bull. Soc. Géol. France* [4], **22**, 234. *Chem. Abstr.* **18**, 1452.

Petroleum in Morocco. A Study of the Folding of the Region of Meknès, Morocco.—A Beaugé and L. Joleaud. *Bull. Soc. Géol. France* [4], **22**, 254. *Chem. Abstr.* **18**, 1452.

Most Colorado Structures now Defined.—A. R. McTee.—*Oil Weekly* **33**, (8), 35.

Wilcox Sand Elusiveness is its Charm.—C. D. Lockwood.—*Oil and Gas J.* **23**, (25), 34.

Heavy Saturation and a Big Sand Body.—C. D. Lockwood. *Oil and Gas J.* **23**, (26), 126.

Relation of Drainage to Great Oilfields.—J. E. Eaton. *Oil Age* **21**, (4), 9. *Chem. Abstr.* **18**, 1633.

REPORT ON TEAPOT DOME NAVAL RESERVE NO. 3, NATRONA CO., WYO.—F. G. Clapp. *Nat. Petr. News* **16**, (13), 69. *Chem. Abstr.* **18**, 1633.

PETROLEUM FROM LAKE TEGERN.—M. Richter. *Petroleum* **20**, 315. *Chem. Abstr.* **18**, 1633.

FOUR HORIZONS BELOW MISSISSIPPI LIME.—L. H. White and F. C. Greene. *Oil and Gas J.* **23**, (15), 42. *Chem. Abstr.* **18**, 1633.

EXAMINATION AND CORRELATION OF FIELD SAMPLES IN GULF COAST.—G. M. Bovier. *Natr. Petr. News* **16**, (13), 85. *Chem. Abstr.* **18**, 1634.

STUDY OF SEDIMENTARY DEPOSITS.—A. Wade. *Oil and Gas J.* **23**, (3A), 96.

THE GEOLOGY AND NATURAL RESOURCES OF COLORADO CO., TEXAS.—T. L. Bailey. *Univ. Texas Bull.* 2333. *Chem. Abstr.* **18**, 1804.

GEOLOGY AND MINERAL RESOURCES OF MCLENNAN CO., TEXAS.—W. S. Adkins. *Univ. Texas Bull.* 2340. *Chem. Abstr.* **18**, 1805.

SMACKOVER OIL FIELD, OUACHITA AND UNION COUNTIES, ARKANSAS.—H. G. Schneider. *Trans. Am. Inst. Mining Met. Eng.* No. 1326-P. *Chem. Abstr.* **18**, 1805.

NOTE ON THE PETROLEUM INVESTIGATIONS CARRIED ON IN LIMAGNE, FRANCE, DURING 1919-22.—P. Glandgeaud. *Ann. Mines* [12], **4**, 1. *Chem. Abstr.* **18**, 1805.

NOTES ON THE PETROLEUM REGION OF GURA-OCNITZEI.—N. Scriban. *Mon. Pétrole Roumain* **24**, 348. *Chem. Abstr.* **18**, 1805.

THE PETROLEUM OF MADAGASCAR.—A. Merle. *Ann. Mines* [12], **3**, 5. *Chem. Abstr.* **18**, 1805.

REPORT ON HUNTINGDON BEACH OIL FIELD.—J. B. Case and V. H. Wilhelm. *State Oil and Gas Supervisor, California State Mining Bureau* (Dec.), 5. *Oil and Gas J.* **23**, (21), 86.

GEOCHEMICAL RELATIONSHIP OF WATERS ENCOUNTERED IN THE HUNTINGDON BEACH FIELD.—*State Oil and Gas Supervisor, California State Mining Bureau* (Dec.), 17.

PETROLEUM AND NATURAL GAS POSSIBILITIES IN GEORGIA.—T. M. Prettyman and H. S. Cave. *Geol. Surv. of Georgia Bull.* 40.

THE OIL INDUSTRY'S STAKE IN GEOLOGICAL RESEARCH.—K. C. Heald. *The Mid-Continent Year Book* **1923**, 28.

COMPARATIVE STRATIGRAPHY IN MONTANA.—C. M. Bauer and E. G. Robinson. *Bull. Amer. Assoc. Petr. Geol.* **7**, 159.

NOTES ON THE KEVIN-SUNBURST OIL FIELD, MONTANA.—F. R. Clark. *Bull. Amer. Assoc. Petr. Geol.* **7**, 263.

RELATION OF UPPER CRETACEOUS TO EOCENE STRUCTURES IN LOUISIANA AND ARKANSAS.—A. F. Crider. *Bull. Amer. Assoc. Petr. Geol.* **7**, 379.

FAULTING IN WYOMING OIL FIELDS.—E. L. Eastabrook. *Bull. Amer. Assoc. Petr. Geol.* **7**, 95.

NOTES ON THE GLENN FORMATION OF OKLAHOMA WITH CONSIDERATION OF NEW PALEONTOLOGIC EVIDENCE.—G. H. Girty and P. V. Roundy. *Bull. Am. Assoc. Petr. Geol.* **7**, 331.

Le Sondage Pétrolifère de Crouelle près de Clermont-Ferrand (Puy-de-Dome). P. Glangeaud. *Comptes rend.* **176**, 816.

Notes on the Stratigraphy of Producing Sands in Northern Louisiana and Southern Arkansas.—J. P. D. Hull. *Bull. Amer. Assoc. Petr. Geol.* **7**, 362.

Oil and Gas Possibilities of Eastern Alberta.—J. S. Irwin. *Bull. Amer. Assoc. Petr. Geol.* **7**, 147.

The Relation of Quality of Oil to Structure at El Dorado, Arkansas.—H. A. Ley. *Bull. Amer. Assoc. Petr. Geol.* **7**, 350.

Petroleum Possibilities of the Salt River Field.—E. S. Sloane. Pamphlet issued by Salt River, Wyoming-Idaho Development Trust.

An Outline of the Results of a Geological Reconnaissance of the Republic of Haiti.—W. P. Woodring. *J. Washington Acad. of Sci.* **15**, 117.

Further Notes on the Hydraulic Theory of Oil Migration and Accumulation.—J. L. Rich. *Bull. Amer. Assoc. Petr. Geol.* **7**, 213.

2. Geographical.

The Search for Oil in Australia.—G. D. Mendell. *Petr. Times* **11**, 762.

The Oilfield of Comodoro Rivadavia.—*The Lamp. Petr. Times* **11**, 725, 767.

Germany's Crude Oil Production for 1923.—*Petr. Times* **11**, 782.

New Zealand.—*Petr. World* **21**, 234.

The Most Southern Oilfield in the World.—*The Lamp. Petr. World* **21**, 235.

British Malaya Oil Trade in 1923.—*U.S. Commerce Repts. Petr. World* **21**, 242.

Scandinavian Oil Statistics.—*Petr. World* **21**, 243.

Properties of California Crude Oils.—A. J. Kraemer and H. M. Smith. *U.S. Bureau Mines Repts. Investigations* 2595. *Petr. World* **21**, 247.

South Africa: Oil Imports in 1923.—*Petr. World* **21**, 247.

Oil Possibilities in Panama.—J. F. Sheridan. *Eng. and Min. J.—Press. Petr. World* **21**, 248.

Oil Trade of Hong Kong in 1923.—*U.S. Commerce Repts. Petr. World* **21**, 253.

Russian Output Materially Increased in 1923.—L. J. Lewery. *Oil Weekly* **23**, (1), 28.

Chart Shows Effect of Flush Wells in 1923.—*Oil Weekly* **33**, (1), 36.

Look for Big Development in Spain during Summer. Some Work under Way.—*Oil Weekly* **33**, (1), 41.

LAWS GOVERNING ROUMANIAN OIL INDUSTRY CHANGED, BUT MANY RESTRICTIONS REMAIN.—*Oil Weekly* **33**, (1), 43.

CROMWELL POOL AVERAGES 1000 BARRELS PER WELL.—*Oil Weekly* **33**, (1), 48.

VENEZUELA AS FACTOR IN OIL SITUATION.—*Oil and Gas J.* **23**, (23), 72.

TONKAWA GAS PRODUCED 34,352,916 BLS.—*Oil and Gas J.* **23**, (21), 58.

PETROLEUM IN PORTUGAL.—*Oil and Gas J.* **23**, (21), 117.

POSSIBILITIES OF OIL AND GAS IN PROVINCE OF ONTARIO, CANADA.—R. B. Harkness. *Canad. Inst. of Min. and Metallurgy. Oil and Gas J.* **23**, (18), 64.

AUSTRALIA EXCITED BY DISCOVERY OF OIL IN WELL IN QUEENSLAND.—*Oil and Gas J.* **23**, (19), 86.

STROUD FIELD JUSTIFIES OPERATORS' FAITH.—C. D. Lockwood. *Oil and Gas J.* **23**, (20), 25.

DEEP TONKAWA SAND STIMULATES DRILLING.—C. D. Lockwood. *Oil and Gas J.* **23**, (22), 36.

MEXICO'S OUTPUT 32,649,837 BARRELS LESS.—G. Blardone. *Oil and Gas J.* **23**, (22), 40.

GENERAL OUTLINE OF REAGAN COUNTY AREA.—H. H. Tucker. *Oil Weekly* **33**, (5), 29.

SEMINOLE LOOMS AS A FACTOR IN OKLAHOMA.—W. L. Sloan. *Oil Weekly* **33**, (5), 34.

SIX PROSPECTIVE DISTRICTS IN TEXAS.—F. J. Fohs. *Oil Weekly* **33**, (5), 21.

CANADIAN RESULTS NOT SO ENCOURAGING.—National Resources Intelligence Service. *Oil Weekly* **33**, (7), 26.

MANY WYOMING STRUCTURES TO BE TESTED.—A. B. Bartlett. *Oil Weekly* **33**, (7), 35.

THE OIL AND GAS POSSIBILITIES OF TEXAS.—F. J. Fohs. *Oil Trade J.* **15**, (5), 44.

IS THERE OIL IN GREECE ?—G. Howell. *Oil Engineering and Finance* **5**, 139. *Chem. Abstr.* **18**, 1381.

MEXICO—THE LAND OF HOPE.—G. Howell. *Oil Engineering and Finance* **5**, 323.

ARGENTINE OIL.—*Oil Engineering and Finance* **5**, 326.

OIL PROSPECTING ON THE NORTH COAST OF VENEZUELA.—M. L. Thomas. *Oil Engineering and Finance* **5**, 327.

IS THERE PETROLEUM IN BRAZIL ?—D. T. Day. *Oil Engineering and Finance* **5**, 331.

THE OIL INDUSTRY OF POLAND.—Dept. of Overseas Trade. *Petr. Times* **11**, 802.

THE PETROLEUM OUTLOOK IN PANAMA.—J. F. Sheridan. *Eng. and Min. J. Press. Petr. Times* **11**, 806.

THE OIL SITUATION IN GERMANY.—*Petr. Times* **11**, 814.

VENEZUELAN OIL HANDBOOK.—M. O'Shaughnessy. Potter and Co., New York.

EMPIRE OIL: THE PROGRESS OF SARAWAK.—T. G. Cochrane. *J. Roy. Soc. Arts* **72**, 308. *Chem. Abstr.* **18**, 1563.

ALBANIAN OIL DISCOVERY.—L. Maddalena. *Oil News* **15**, 632.

ITALY: OIL IMPORTS IN 1923.—*U.S. Commerce Rept. Oil News* **15**, 633.

RUSSIA'S TWO GREAT NEW WELLS.—*Oil News* **15**, 674.

COMPOSITION OF JAPANESE PETROLEUM.—I.—S. Komatsu and S. Kusumoto *Mem. Coll. Sci. Kyoto Imp. Univ.* **7**, 77. *Chem. Abstr.* **18**, 1562.

COMPOSITION OF JAPANESE PETROLEUM.—II.—S. Komatsu and N. Tanaka. *Mem. Coll. Sci. Kyoto Imp. Univ.* **7**, 143. *J. Soc. Chem. Ind.* **43**, B 499.

THE PHYSICAL AND CHEMICAL PROPERTIES OF TYPICAL CRUDE OILS OF CALIFORNIA.—*U.S. Bureau Mines Repts. Investigations* 2608. *Petr. Times* **11**, 878.

PROMISING OIL AREA IN SOUTH AUSTRALIA.—H. C. Dodd. Ind. Australian and Mining. *Petr. Times* **11**, 882.

LULING FIELD COULD PRODUCE 100,000 BLS.—J. McIntyre. *Oil and Gas J.* **23**, (24), 24.

TOTAL OF 563 REFINERIES IN UNITED STATES.—C. O. Willson. *Oil and Gas J.* **23**, (25), 58.

QUESTION AS TO CALIFORNIAN CRUDES IS YET UNSETTLED.—C. E. Korn. *Oil and Gas J.* **23**, (26), 92.

SWIGART INVESTIGATED EUROPEAN OIL MINES.—J. F. Carter. *Oil Weekly* **33**, (9), 19.

OIL DEVELOPMENTS IN CZECHO-SLOVAKIA.—*Petr. Times* **11**, 917.

COLORADO'S EFFECT ON OIL INDUSTRY YEAR OFF; FIELDS CONTROLLED.—P. Wagner. *Nat. Petr. News* **16**, (21), 17.

WHAT KIND OF OIL COUNTRY COLORADO IS.—*Nat. Petr. News* **16**, (22), 87.

PROPERTIES OF CALIFORNIA CRUDE.—U.S. Bureau Mines. *Petr. World* **23**, 274.

POLAND: OIL INDUSTRY IN 1923.—*Petr. World* **21**, 277.

ITALY'S OIL IMPORTS IN 1923.—*U.S. Commerce Repts. Petr. World* **21**, 286.

THE NATURAL WEALTH OF PERU.—G. Howell. *Oil Engineering and Finance* **5**, 388.

THE OILFIELDS OF TRINIDAD. FINANCIAL REVIEW.—*Oil Engineering and Finance* **5**, 393.

"KOSMACZ" PETROLEUM.—J. W. Florjan. *Przemysl Chem.* **6**, 229. *Chem. Abstr.* **18**, 1744.

NOTE SUR LES RECHERCHES DE PÉTROLE EN LIMAGNE.—P. Glangeaud. J. Hermann, Paris.

CROMWELL PRODUCTIVE AREA UNDEFINED TO NORTH-WEST AND SOUTH-EAST.—A. F. Hinton. *Nat. Petr. News* **16**, (26), 24.

HISTORY OF ROUMANIAN OIL INDUSTRY MAY BE DIVIDED INTO THREE STAGES.—*Oil and Gas J.* **23**, (2A), 129.

CROMWELL POOL MAY REACH 100,000 BLS.—C. D. Lockwood. *Oil and Gas J.* **23**, (3A), 24.

PRODUCTION OF PETROLEUM IN PERU.—F. V. Marsters. *Oil and Gas J.* **23**, (3A), 64.

COLORADO OIL NOT TO BE DISTURBING.—L. M. Fanning. *Oil and Gas J.* **23**, (5A), 32.

OIL POSSIBILITIES IN SOUTH DAKOTA WEST OF THE MISSOURI RIVER.—C. T. Lupton and E. M. Parks. Am. Assn. Petr. Geol. *Oil and Gas J.* **23**, (5A), 78.

OIL PRODUCTION IN CZECHO-SLOVAKIA IS COMPARATIVELY SMALL.—*Oil and Gas J.* **23**, (5A), 100.

PÉTROLE EN FRANCE.—M. Lecomte-Denis. Dunod, Paris.

PROPERTIES OF CALIFORNIA CRUDE OILS. II. ADDITIONAL ANALYSES.—A. J. Kraemer and H. M. Smith. *U.S. Bureau Mines Repts. Investigations* 2608.

ANALYSIS OF TWO NEW CZECHOSLOVAKIA CRUDE PETROLEUMS.—M. I. Chorkavcis and D. Prunet. *Chim. et Ind.* **11**, 260. *Chem. Abstr.* **18**, 1900.

PETROLEUM IN PERU.—S. F. Bodoya. *The Mid-Continent Year Book*, 36.

PETROLEUM REFINERY STATISTICS FOR 1923.—W. C. Hill. *U.S. Bureau Mines* (Feb.).

PROSPECTS OF OIL IN GUATEMALA.—F. S. Latour. *The Mid-Continent Year Book*, 25.

CONSERVATION RULES AND REGULATIONS, STATE OF ARKANSAS, ORDER NO. 284.—*The Mid-Continent Year Book*, 131.

DEVELOPMENT WORK—MID-CONTINENT FIELD.—*The Mid-Continent Year Book*, 151.

UNITED STATES PETROLEUM PRODUCTION.—*The Mid-Continent Year Book*, 153.

REMINISCENCES OF EARLY OIL DEVELOPMENT IN CALIFORNIA.—W. W. Orcutt. *Union Oil Co. of California Bull.* **3**, 1.

A REVIEW OF FOREIGN OIL DEVELOPMENTS.—*Oildom Daily* **15**, (April 8), 1.

PETROLEUM IN MEXICO.—M. P. y Lasso. *The Mid-Continent Year Book*, 46.

CANADA'S OIL REFINERIES.—*Canad. Min. J.* **44**, 477.

LE PÉTROLE AU MEXIQUE.—E. L. Dohemy. *Le Courrier des Pétroles* **4**, (34), 2; (35), 2.

THE WAINWRIGHT OIL AND GAS AREA, ALBERTA.—G. S. Hume. *Canad. Min. J.* **44**, 1001.

THE OIL FIELDS OF THE RAWLINS LOST SOLDIER DISTRICT, WYOMING.—E. W. Kampert. *Bull. Amer. Assn. Petr. Geol.* **7**, 131.

A BRIEF HISTORY OF THE OIL INDUSTRY IN MONTANA.—E. G. Robinson. *Midwest Review* **4**, 30.

RESERVES OF CRUDE OIL IN POLAND.—S. Bartoszewicz. *Petr. Times* **12**, 52.

MINERAL OIL PROSPECTS IN NEW ZEALAND.—*Petr. Times* **12**, 73.

3. DRILLING AND FIELD OPERATIONS.

SOME SIDELIGHTS ON USING CEMENT IN WELLS.—H. Pennington. *Oil Weekly* **33**, (1), 21.

AUTOMATIC LUBRICATOR FOR FIELD ENGINES IS SUCCESS.—*Oil Weekly* **33**, (1), 83.

STEAM FIRE SNUFFER HAS ADVANTAGEOUS FEATURES.—*Oil Weekly* **33**, (1), 83.

SPRING CASING HOOK AND DRILL PIPE SLIP.—*Oil and Gas J.* **23**, (21), 74.

DEVICE FOR DRILLING WITH GAS ENGINE MAY SOLVE WATER PROBLEM.—C. Vinson. *Oil and Gas J.* **23**, (18), 130.

NEW NON-REVERSIBLE LIGHT WEIGHT DRILL.—*Oil and Gas J.* **23**, (19), 60.

NEW WELL REAMER.—*Oil and Gas J.* **23**, (22), 74.

FLEXIBLE DRILL PIPE SLIP.—*Oil and Gas J.* **23**, (22), 74.

SAFETY MEASURES HUMANITARIAN BESIDES DISCOUNTING MONETARY LOSSES.—P. Wagner. *Nat. Petr. News* **16**, (19), 56.

RESTORATION OF PRESSURE TO OIL SAND INCREASING IN OIL FIELDS.—L. E. Smith. *Nat. Petr. News* **16**, (19), 71.

MAINTENANCE PLAYS BIG PART IN OUTPUT.—L. Suverkrop. *Oil Weekly* **33**, (6), 23.

CEMENT BASKET SAID TO SAVE STRING OF TUBING.—*Oil Weekly* **33**, (6), 75.

ROTARY TONG CHARACTERISED BY TIME SAVING FEATURES.—*Oil Weekly* **33**, (6), 75.

IRREGULARITIES IN PIPE TAKEN CARE OF BY SLIP.—*Oil Weekly* **33**, (6), 75.

SPRING CASING HOOK SERVES TO RELIEVE STRAIN ON RIG.—*Oil Weekly* **33**, (5), 83.

SPENCE POWER UNIT STANDS UNUSUAL TEST IN ACCIDENT.—*Oil Weekly* **33**, (5), 83.

MYRACLE SUCKER ROD SOCKET CUTS THREAD ON BROKEN ROD.—*Oil Weekly* **33**, (5), 83.

MUCH TROUBLE CAUSED BY CROOKED HOLES.—F. G. D. Muller. *Oil Weekly* **33**, (5), 27.

RUFNER ROTARY BIT STANDS UP WELL UNDER HARD TESTS.—*Oil Weekly* **33**, (5), 75.

MANY SAFETY FEATURES IN CUNNINGHAM ROD ELEVATOR.—*Oil Weekly* **33**, (5), 75.

PUMPING IN MUD UNDER HIGH PRESSURE.—H. B. Thompson. *Oil Weekly* **33**, (7), 24.

PROMOTE SAFETY AND REDUCE TIME LOSSES.—*Oil Weekly* **33**, (7), 29.

FROST VERTICAL GENERATOR WITHSTANDS UNUSUAL TEST.—*Oil Weekly* **33**, (7), 83.

NEW TURNBUCKLE DERRICK.—*Oil Trade J.* **15**, (5), 36.

FIRE CONE PERFECTED FOR EXTINGUISHING OIL AND GAS WELL FIRES.—*Oil Trade J.* **15**, (5), 36.

KAHLE FLOWING DEVICE REDUCES LIFTING WEIGHT AND COST.—*Oil Trade J.* **15**, (5), 36.

NEW "THRIFT" PACKER PLUG REDUCES EXPENSE.—*Oil Trade J.* **15**, (5), 38.

PORTABLE PIPE THREADING, CUTTING AND REAMING MACHINE BEING MARKETED. *Oil Trade J.* **15**, (5), 38.

DANGER OF OVERDOING STANDARDISATION.—H. Pennington. *Oil Weekly* **33**, (3), 11.

METHODS OF LOGGING ROTARY DRILLED WELLS.—E. Kraus. *Oil Weekly* **33**, (3), 21.

SIMPLICITY BEST FEATURE OF THOMPSON VALVE PULLER.—*Oil Weekly* **33**, (3), 83.

EMSCO ROTARY DISC BIT HAS MARKED ADVANTAGES.—*Oil Weekly* **33**, (3), 83

THE EVOLUTION OF OIL-WELL DRILLING METHODS.—A. B. Thompson *Oil News* **15**, 621. *Petr. Times* **11**, 896.

SAFETY MEASURES IN PETROLEUM MINING.—G. Schneider. *Petroleum* **20**, 271. *Chem. Abstr.* **18**, 1563.

METHODS FOR ELIMINATING PARAFFIN FROM OIL WELLS.—*Petr. Times* **11**, 844.

LINK-BELT COMPANY PUTS OUT NEW OIL WELL CHAIN.—*Oil Weekly* **33**, (8), 91. *Petr. Times* **11**, 880.

WOODEN BRIDGING PLUG IN USE IN CALIFORNIA FIELDS.—*Oil Weekly* **33**, (8), 91.

USE OF MUD FLUID IN ROTARY-DRILLED WELLS.—M. J. Kirwan. *Oil and Gas J.* **23**, (26), 59. *Petr. World* **21**, 265.

STANDARDISATION OF ROTARY DRILLING EQUIPMENT ADVANCED.—*Oil and Gas J.* **23**, (26), 84.

STANDARDISATION GIVEN IMPETUS AT MEETING.—A. R. McTee. *Oil Weekly* **33**, (9), 22.

COMPLETING AN OIL WELL AND STARTING PRODUCTION.—W. W. Copp. *Oil Weekly* **33**, (9), 35.

NEW BAILER BOTTOM WILL PREVENT LOSING IN WELL.—*Oil Weekly* **33**, (9), 83.

SMITHSTEEL COUPLINGS MADE TO STAND GREATER STRAINS.—*Oil Weekly* **33**, (9), 83.

PNEUMATIC DRILL EMBODIES FEATURES OF PORTABILITY.—*Oil Weekly* **33**, (9), 83.

SPECIAL FEATURES EMBODIED IN COMBINATION DERRICK.—*Oil Weekly* **33**, (10), 75.

PORTABLE ROTARY DRILLING OUTFIT TESTED AT HOUSTON.—*Oil Weekly* **33**, (10), 75.

LONG STROKE PUMPS FOR OIL WELLS.—G. R. Taaffe. *Oil Weekly* **33**, (11), 25.

NEW FOOL PROOF ROD GIVES SUCCESS IN CALIFORNIA.—*Oil Weekly* **33**, (11), 89.

PULLING ATTACHMENT WORKS ON REAR WHEELS OF TRUCK.—*Oil Weekly* **33**, (11), 89.

PORTABLE DRILLING OUTFIT GOOD FOR DRILLING 3500 FT.—*Oil Weekly* **33**, (11), 90.

SIMPLICITY OF DESIGN BIG POINT IN NEW FLOW NIPPLE.—*Oil Weekly* **33**, (11), 91.

THE USE OF FLUIDS IN CLEANING OIL WELLS.—L. Suverkrop. *Petr. Times* **11**, 935.

EFFECTS OF APPLYING VACUUM TO GAS FLOW.—H. Pennington. *Ref. and Nat. Gas. Mfr.* **3**, (6), 13.

STANDARD SEAMLESS CASING.—*Ref. and Nat. Gas. Mfr.* **3**, (6), 35.

CROMWELL'S FIRST GAS WELL FIRE RESISTS FIGHTERS 12½ DAYS.—A. F. Hinton. *Nat. Petr. News* **16**, (21), 27.

AGREE ON SPECIFICATIONS FOR OIL FIELD EQUIPMENT.—P. Wagner. *Nat. Petr. News* **16**, (21), 48.

EASY WAY TO REPLACE WRECKED DERRICK.—*Nat. Petr. News* **16**, (21), 69.

SOME METHODS OF PROLONGING NATURAL FLOW OF OIL WELLS.—J. M. Lovejoy. *Nat. Petr. News* **16**, (21), 71.

RECOVERY OF OIL BY SHAFTS AND GALLERIES IN FRANCE AND GERMANY.—C. Camsell and A. Buisson. *Nat. Petr. News* **16**, (21), 99.

AIR SUCCESSFUL IN INCREASING FLOW OF WELLS AT POWELL.—L. E. Smith. *Nat. Petr. News* **16**, (24), 40.

SETTING CEMENT WITH DYNAMITE SUCCESSFUL.—P. Wagner. *Nat. Petr. News* **16**, (24), 93.

SOME IMPORTANT CONSIDERATIONS IN DRILLING.—W. W. Copp. *Petr. World* **21**, 271.

STANDARDISING THE ROTARY AND ITS EQUIPMENT.—*Petr. World* **21**, 294.

A TEXTBOOK OF PETROLEUM PRODUCTION ENGINEERING.—L. C. Uren. McGraw Publishing Co., Ltd., London.

SOME FACTORS IN OIL LEASE OPERATION.—H. P. Porter. Am. Inst. Min. and Met. Engineers. *Nat. Petr. News* **16**, (20), 102, (21), 77.

OKLAHOMA LABOUR COMMISSIONER PROPOSES DRASTIC SAFETY REGULATIONS.—A. F. Hinton. *Nat. Petr. News* **16**, (25), 39.

ELECTRICITY VERSUS STEAM IN OIL WELL DRILLING.—*Nat. Petr. News* **16**, (26), 80.

CONSISTENT REPAIRING OF WELLS GREATLY BENEFITS NORTH CUSHING FIELD.—L. E. Smith. *Nat. Petr. News* **16**, (26), 83.

NEW RECORDS MADE IN DRILLING DUSTER TO DEPTH OF 7212 FT.—*Oil and Gas J.* **23**, (2A), 140.

MUCH "FISHING" DECLARED UNJUSTIFIABLE.—R. T. Baker. *Oil and Gas J.* **23**, (4A), 25.

REDUCING ACCIDENTS IN MID-CONTINENT.—R. S. Bonsib. *Oil and Gas J.* **23**, (4A), 54.

STEEL STANDS TEST.—*Oil and Gas J.* **23**, (5A), 56.

THE AEROPLANE IN THE OIL FIELDS.—A. E. Fowks. *Union Oil Co. of California Bull.* **3**, (Dec.), 28.

OIL AND GAS CONSERVATION.—G. C. and S. H. Gester, and E. W. Wagy. *Standard Oil Co. of California Bull.* **11**, (Dec.), 2.

HOW MUCH MORE OIL CAN BE EXTRACTED FROM THE OIL SANDS?—J. O. Lewis. *The Mid-Continent Year Book*, 145.

SAFETY WORK IN THE MID-CONTINENT FIELD.—*The Mid-Continent Year Book*, 113.

THE HUGHES-McKIE OIL WELL FIRE.—*Nat. Fire Protection Assn. Quart.* **17**, (July), 76.

OIL FIRE FIGHTING.—*Nat. Fire Protection Assn. Quart.* **16**, 339.

PROPOSED SPECIFICATIONS FOR STEEL AND IRON PIPE FOR OIL COUNTRY TUBULAR GOODS.—J. E. Pew. *The Mid-Continent Year Book*, 85.

NOTES ON CALIFORNIA OIL FIELD PRACTICE.—R. E. Collom. *Bull. Amer. Assoc. Petr. Geol.* **7**, 114.

CORE DRILLING WITH ROTARY TOOLS IN CALIFORNIA.—J. E. Elliott. *Bull. Amer. Assoc. Petr. Geol.* **7**, 250.

STEEL AND THE PETROLEUM INDUSTRY.—F. B. Foley. *Bull. Amer. Petr. Inst.* **4**, 97.

REPORT OF COMMITTEE ON STANDARDISATION OF ROTARY TOOL JOINTS.—S. A. Guiberson. *Bull. Amer. Petr. Inst.* **4**, 107.

REPORT OF BOLT STANDARDISATION COMMITTEE.—R. D. Gwynne. *Bull. Amer. Petr. Inst.* **4**, 109.

REPORT OF COMMITTEE ON THE STANDARDISATION OF CABLE DRILLING TOOL JOINTS.—G. Hubley. *Bull. Amer. Petr. Inst.* **4**, 111.

THE USE OF ELECTRICITY IN THE OIL FIELDS.—W. G. Taylor. *Bull. Amer. Petr. Inst.* **4**, 100.

DESIGNING AND MARKETING OF SAFE DRILLING EQUIPMENT.—*Petr. Times* **12**, 49.

Patents.

Treating Oil as Delivered from Wells.—W. J. Knox. U.S. Pat. 1,484,718. *Chem. Abstr.* **18**, 1384.

Oil-well Grapple.—J. Bajus. U.S. Pat. 1,486,624. *Nat. Petr. News* **16**, (19), 99.

Double Packer for Liners.—T. H. Gallagher. U.S. Pat. 1,487,097. *Nat. Petr. News* **16**, (19), 99.

Oil-well Pump.—T. J. Barger. U.S. Pat. 1,487,431. *Nat. Petr. News* **16**, (19), 99.

Intake for Oil-well Pumps.—J. J. Fitzpatrick. U.S. Pat. 1,488,106. *Nat. Petr. News* **16**, (19), 99.

Oil-well-Controlling Valve Attachment.—A. L. Looffler. U.S. Pat. 1,488,211. *Nat. Petr. News* **16**, (19), 99.

A Gas Oil and Sand Separator.—H. M. Gill. U.S. Pat. 1,490,462. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39.

Oil Well Pump.—E. W. Hulsey. U.S. Pat. 1,488,987. *Nat. Petr. News* **16**, (24), 83.

Method and Apparatus for Cementing Oil Wells.—F. W. Taber. U.S. Pat. 1,490,143. *Nat. Petr. News* **16**, (24), 84.

Method of Shutting Off Water in Oil Wells.—J. J. Smit. U.S. Pat. 1,491,427. *Nat. Petr. News* **16**, (24), 84.

Raising Oil, etc., from Wells.—J. B. Mayberry. Brit. Pat. 213,925. *Oil Engineering and Finance* **5**, 420.

Oil-well Attachment.—W. E. Hancock. U.S. Pat. 1,412,863.

Apparatus for Pumping Oil.—J. D. Nixon. U.S. Pat. 1,412,886.

Oil Well.—J. Penrod and R. D. Thompson. U.S. Pat. 1,413,130.

Bailer Structure.—F. B. Alldredge. U.S. Pat. 1,421,363.

Oil-well Drill Bit.—R. J. Brown. U.S. Pat. 1,421,396.

Oil-well Tool.—G. F. Hoap. U.S. Pat. 1,424,820.

Oil-well Packer.—C. M. Hector. U.S. Pat. 1,423,213.

Oil-well Packer.—C. M. Hector. U.S. Pat. 1,422,704.

Casinghead Attachment.—F. Kinzbach. U.S. Pat. 1,425,022.

Lubricating System for Deep-well Pumps.—F. W. Krogh. U.S. Pat. 1,424,362.

Oil-well Pump.—J. L. Larkin and R. L. Gordon. U.S. Pat. 1,423,860.

Drilling Device.—W. S. McBride. U.S. Pat. 1,424,109.

Well Drill.—I. J. McCullough. U.S. Pat. 1,424,662.

Deep-well Pump.—E. D. McDonald. U.S. Pat. 1,422,588.

EXCLUDING WATER FROM OIL AND GAS WELLS.—R. V. Mills. U.S. Pat. 1,421,706.

WELL PUMP.—J. Penrod and R. D. Thompson. U.S. Pat. 1,425,276.

WELL-CLEANING DEVICE.—F. J. Rogers. U.S. Pat. 1,423,625.

UNDERREAMER.—J. Swan. U.S. Pat. 1,422,236.

4. PIPE-LINES, TRANSPORT AND STORAGE.

OIL TANK FIRES EXTINGUISHED BY WATER.—*Oil News* **15**, 581.

A NEW METHOD OF ROAD OIL TRANSPORT.—*Petr. Times* **11**, 759.

FOAM METHOD PROTECTION AGAINST FIRES.—*Oil and Gas J.* **23**, (18), 92.

NEW DITCHING MACHINE MODEL SHOWS CHANGES.—*Oil and Gas J.* **23**, (20), 86.

METHOD FOR REPAIRING BREAK IN PIPE LINE.—*Oil and Gas J.* **23**, (20), 98.

STATIC HAZARDS IN HANDLING GASOLINE.—C. L. Naylor and H. E. Ramsey. *Oil and Gas J.* **23**, (23), 100.

RECOVERING LOSSES FROM STORAGE TANKS.—C. P. Buck. *Oil Weekly* **33**, (5), 21; (6), 29.

USES WATER FOR EXTINGUISHING OIL FIRES.—*Oil Weekly* **33**, (7), 23.

PIPE LINE VALVE LOCK IS ADAPTABLE TO ANY VALVE.—*Oil Weekly* **33**, (7), 83

FUEL OIL STORAGE TANKS, THEIR EFFECT AND VALIDITY.—A. W. Gray. *Oil Trade J.* **15**, (5), 32.

USE OF PUMPS FOR PIPE LINE SERVICE.—E. S. Jenison. *Oil Trade J.* **15**, (5), 52.

CHART FOR COMPUTING TANK CONTENTS.—*Oil News (U.S.A.)* **12**, (3), 34. *Chem. Abstr.* **18**, 1352.

GOOD PRACTICE IN HANDLING AND STORING LUBRICANTS.—*Lubrication* **10**, 1.

EXPLOSION LIMITS AND FLASH POINTS OF COMBUSTIBLE LIQUIDS.—H. Strache. *Oesterr. Chem. Zeit.* **27**, 19. *Chem. Abstr.* **18**, 1572.

STORAGE OF FLAMMABLE LIQUIDS.—A. Neuberger. *Chem.-Zeit.* **48**, 277. *Chem. and Met. Eng.* **30**, 918.

VAPOUR-TIGHT TANKS, WELL VENTED, WILL REDUCE FIRE HAZARD.—W. C. Platt. *Nat. Petr. News* **16**, (22), 111.

WATER PUTS OUT OIL FIRES.—*Oil News* **16**, 42.

REDUCTION OF REFINERY LOSSES BY FLOATING TANK DECKS.—R. Cross. *Oil and Gas News* **14**, (2), 68. *Chem. Abstr.* **18**, 1745.

PROPER VENTING WILL SAVE STORAGE TANKS.—S. H. Brooks. *Oil Weekly* **33**, (12), 25. *Nat. Petr. News* **16**, (20), 55.

DESIGN OF OIL TANK FIRE WALLS.—F. W. Babbitt. *Eng. News-Record* **90**, 1132.

A New Form for Oil Storage Protection.—J. M. Jennings. *Nat. Fire Protection Assn. Quart.* **16**, 250.

Oil Refining and Storage Fire Record.—*Nat. Fire Protection Assn. Quart.* **16**, 373.

Problems of Pipe Line Transportation.—D. S. Bushnell. *Bull. Amer. Petr. Inst.* **4**, 144.

How Colour Reduced the Evaporation of Oil.—W. T. Deacon. *Oil News* (*U.S.A.*) **11**, (18), 13.

Oil Marine Transportation.—J. C. Roblfs. *Bull. Amer. Petr. Inst.* **4**, 147.

Patents.

Handling Viscous Fluids.—H. H. Norton and E. E. Hobbs. U.S. Pat. 1,492,742. *Chem. and Met. Eng.* **30**, 916.

Art of Preventing Loss by Evaporation from Storage Tanks.—R. E. Wilson, Assgd. to Standard Oil Co., Indiana. U.S. Pat. 1,489,725. *Nat. Petr. News* **16**, (24), 83. *Chem. Abstr.* **18**, 1865.

Vacuum Sampler for Tanks of Refined Oil and Gasoline.—C. E. Johnson. U.S. Pat. 1,416,354.

5. Refinery Technique.

Colloidal Clays for Bleaching Oils.—*Chem. and Met. Eng.* **30**, 783.

Problems in the Refining of Cracked Distillates.—J. C. Morrell. *Chem. and Met. Eng.* **30**, 785. *Petr. Times* **11**, 838.

Use California Clay in Alsatian Refinery.—*Oil and Gas J.* **23**, (21), 90.

For Cleaning Tanks of Sludge Sentiment.—*Oil and Gas J.* **23**, (22), 74.

Larger and Better Recovery by Stabiliser.—L. F. Bayer. *Oil and Gas J.* **23**, (22), 92.

Methods of Recovering Gasoline from Uncondensed Still Vapours.—D. B. Dow. *Oil and Gas J.* **23**, (22), 110.

The Theory of Fractional Condensation.—E. H. Leslie. *Oil News* (*U.S.A.*) **12**, (3), 15. *Chem. Abstr.* **18**, 1349.

Heat Transmission in Coolers, Heaters and Condensers.—B. Heastie. *J. Soc. Chem. Ind.* **42**, 443T. *Chem. Abstr.* **18**, 1350.

Heat Transmission from Bare and Insulated Pipes.—R. H. Heilman. *Ind. Eng. Chem.* **16**, 451. *Chem. Abstr.* **18**, 1350.

Optimum Operating Conditions for Pipe Heating and Cooling Equipment.—W. K. Lewis, J. T. Ward and E. Voss. *Ind. and Eng. Chem.* **16**, 467. *Chem. Abstr.* **18**, 1350.

Loss of Heat from Furnace Walls.—R. Calvert and L. Caldwell. *Ind. and Eng. Chem.* **16**, 483. *Chem. Abstr.* **18**, 1351.

HEAT TRANSFER FOR WATER FLOWING IN PIPES.—W. H. McAdams and T. H. Frost. *Chem. and Met. Eng.* **30**, 234. *Chem. Abstr.* **18**, 1351.

CONTROLLING VOLUMES AND TEMPERATURES IN REFINING OPERATIONS.—H. S. Bell. *Nat. Petr. News* **16**, (8), 71. *Chem. Abstr.* **18**, 1382.

THE USE OF MEASURING INSTRUMENTS IN OIL REFINING. I.—H. S. Bell. *Nat. Petr. News* **16**, (2), 39. *Chem. Abstr.* **18**, 1382.

SAVING EFFECTED BY USE OF STABILISER.—L. F. Bayer. *Ref. and Nat Gas. Mfr.* **3**, (5), 10. *Nat. Petr. News* **16**, (18), 24.

COMPACTNESS MAKES FOR PORTABLE PLANT.—*Ref. and Nat. Gas. Mfr.* **3**, (5), 25.

DOHERTY MAKES PRODUCTS WITH NEW TYPE PROCESS.—*Ref. and Nat. Gas. Mfr.* **3**, (5), 48.

DECOLORISING OF MINERAL OILS.—H. Moore. *Oil Engineering and Finance* **5**, 357.

A BRITISH OIL-REFINING ENTERPRISE.—*Petr. Times* **11**, 798.

TEN YEARS OF PROGRESS IN PETROLEUM REFINING.—*The Lamp* (April). *Chem. and Met. Eng.* **30**, 823.

MODERN HEAT EXCHANGE EQUIPMENT.—G. A. Burrell. *Chem. Met. Eng.* **30**, 463. *Chem. Abstr.* **18**, 1564.

REFINERY HEAT LOSSES.—H. S. Bell. *Nat. Petr. News* **16**, (13), 62. *Chem. Abstr.* **18**, 1564.

CUTTING DOWN HEAT LOSSES BY PROPER INSULATION.—H. S. Bell. *Nat. Petr. News* **16**, (14), 93. *Chem. Abstr.* **18**, 1564.

BAUXITE AS A REFINING AGENT FOR PETROLEUM DISTILLATION.—A. E. Dunstan and F. G. P. Remfry. *J. Soc. Chem. Ind.* **43**, 179T. *Petr. Times* **12**, 17.

THE TECHNICAL USE OF BAUXITE IN CONNEXION WITH PETROLEUM REFINING.—A. M. O'Brien. *J. Soc. Chem. Ind.* **43**, 188T.

THE EFFICIENCY OF FRACTIONATING COLUMNS.—G. Calingaert and F. E. Huggins. *Ind. and Eng. Chem.* **16**, 584.

EINFACHE UND FRAKTIONIERTE DESTILLATION IN THEORIE UND PRAXIS.—C. V. Rechenberg. Schimmel and Co., Leipzig.

ARGILLACEOUS EARTHS IN THE REFINING OF PETROL. STUDY OF THE PHENOMENA OF FILTRATION THROUGH ARGILLACEOUS EARTHS.—A. Guiselin. *Les Matières Grasses* **17**, 6783.

HYPOCHLORITE PROCESS (FOR PURIFYING PETROLEUM DISTILLATES).—A. E. Dunstan. *Chem. Weekblad* **21**, 193. *J. Soc. Chem. Ind.* **43**, B 500.

CONTACT FILTRATION LIKELY TO BECOME IMPORTANT FEATURE IN REFINING.—W. S. Zehrung. *Nat. Petr. News* **16**, (23), 27.

HEAT TRANSMISSION FROM BARE AND INSULATED PIPES.—R. H. Heilman. *Ind. and Eng. Chem.* **16**, 451. *J. Soc. Chem. Ind.* **43**, B 541.

A NEW OIL REFINING AGENT.—*Petr. Times* **11**, 926.

THE TREATMENT OF GASOLINE BY BLEACHING POWDER.—*Petr. Times* **11**, 940.

PROBLEMS IN THE REFINING OF CRACKED DISTILLATES.—J. C. Morrell. *Chem. and Met. Eng.* **30**, 785. *J. Soc. Chem. Ind.* **43**, B 547.

REFRIGERATION AS APPLIED TO DEWAXING OF LUBRICANTS.—L. D. Jones. International Refrigeration Congress. *Chem. Age* **11**, 9.

METHODS OF TREATING LUBRICATING OILS.—C. J. von Bibra. *Ref. and Nat. Gas. Mfr.* **3**, (6), 9.

SAFETY FEATURES PART OF OPERATING PLAN.—A. R. McTee. *Ref. and Nat. Gas. Mfr.* **3**, (6), 21.

SALVAGE LUMBER YARD MEANS BIG SAVING.—G. J. Prentice. *Standolind Record. Ref. and Nat. Gas. Mfr.* **3**, (6), 31.

NEW FIRE FIGHTING DEVICE IS OFFERED TO REFINERS.—*Ref. and Nat. Gas. Mfr.* **3**, (6), 35.

INVINCIBLE BUILDS FIRST LUB PLANT IN NORTH LOUISIANA FIELD.—J. C. Chatfield. *Nat. Petr. News* **16**, (24), 52.

THERMAL AND PHYSICAL VALUES OF STILL INSULATION.—L. C. Converse. *Nat. Petr. News* **16**, (24), 87.

ACID TREATMENT OF KEROSENE DISTILLATE.—W. M. Fraser. *Oil and Gas J.* **23**, (2A), 100.

HYDROCHLORIC PROCESSES AND CHEMICALS FOR PETROLEUM INDUSTRY.—The Mathieson Alkali Works, Inc., New York.

SILICA GEL.—H. C. A. Holleman. *Chem. Weekblad* **21**, 187. *Chem. Abstr.* **18**, 1883.

THE PETROLEUM INDUSTRY.—A. Sée. *Tech. moderne* **16**, 284. *Chem. Abstr.* **18**, 1900.

GETTING THE MOST OUT OF MEXICAN CRUDE.—F. N. Williams. *Ref. and Nat. Gas. Mfr.* **3**, (1), 7; (2), 15. *Chem. Abstr.* **18**, 1900.

COOLING CONDENSER WATER.—H. Pennington. *Ref. and Nat. Gas. Mfr.* **3**, (4), 9. *Chem. Abstr.* **18**, 1902.

NATURAL GASOLINE MANUFACTURERS MAKE STRIDES IN STABILISATION.—J. C. Chatfield. *Nat. Petr. News* **16**, (16), 39. *Chem. Abstr.* **18**, 1902.

SOME DONT'S TO BE REMEMBERED IN TREATING OIL.—*Oil News* (*U.S.A.*) **11**, (18), 25.

CHINA CLAY FOR CLARIFYING OILS.—*Chem. Age* (*China Clay Trade Review Section*) **10**, (262), 8.

PATENTS.

PROCESS FOR PURIFYING MINERAL OILS FROM SULPHUR.—Brit. Pat. 214,733. The Anglo-Saxon Petroleum Co., Ltd. From E. S. Hillman. *Chem. Age* **10**, 577. *J. Soc. Chem. Ind.* **43**, B 550.

PURIFYING MINERAL OILS.—V.L. Oil Processes, Ltd., and O. D. Lucas. Brit. Pat. 211,664. *Oil Engineering and Finance* **3**, (5), 341. *J. Soc. Chem. Ind.* **43**, B 366. *Chem. Age* **10**, 333. *Chem. Abstr.* **18**, 1903.

PURIFYING MINERAL OILS.—F. G. P. Remfry. Brit. Pat. 212,500. *Oil Engineering and Finance* **3**, (5), 341. *J. Soc. Chem. Ind.* **43**, B 439. *Chem. Age* **10**, 415.

PURIFYING MINERAL OILS.—Union Oil Co. Brit. Pat. 213,881. *Chem. Age* **10**, 603.

PROCESS OF TREATING SPENT CLARIFYING AND DECOLORISING AGENTS.—M. L. Chappell, E. P. Wright and M. L. Moore, Assrs. to Standard Oil Co. U.S. Pat. 1,488,895. *J. Soc. Chem. Ind.* **43**, B 460.

PURIFICATION OF NAPHTHENIC ACIDS.—W. Schrauth. Ger. Pat. 390,847. *J. Soc. Chem. Ind.* **43**, B 460.

DECOLORISING CLAYS.—J. W. Kier and J. C. Black. U.S. Pat. 1,492,184 *Chem. and Met. Eng.* **18**, 876. *J. Soc. Chem. Ind.* **43**, B 503.

TREATING ACID SLUDGE.—E. C. Higgins and O. C. Smith, Assgd. to Coeden and Co. U.S. Pat. 1,487,240. *Chem. and Met. Eng.* **30**, 916. *J. Soc. Chem. Ind.* **43**, B 411. *Chem. Abstr.* **18**, 1747. *Nat. Petr. News.* **16**, (19), 99.

PROCESS FOR THE PREVENTION OF THE FORMATION OF EMULSIONS.—H. A. Gill, from The Sharples Specialty Co. Brit. Pat. 215,929. *Chem. Age* **15**, 652.

PREPARATION OF GAS MIXTURES RICH IN METHANE OR ETHYLENE.—Farbenfabr. vorm. F. Bayer und Co., Assees. of J. Behrens. Ger. Pat. 391,766. *J. Soc. Chem. Ind.* **43**, B 502.

METHOD OF TREATING (MINERAL OILS).—G. E. Heyl. Brit. Pat. 213,946. *J. Soc. Chem. Ind.* **43**, B 503. *Oil Engineering and Finance* **5**, 420.

REFINING MINERAL OILS, LOW-TEMPERATURE TARS AND THE LIKE.—H. Hutz. Ger. Pat. 391,624. *J. Soc. Chem. Ind.* **43**, B 503.

TREATMENT OF LIQUID HYDROCARBONS.—A. E. Dunstan. U.S. Pat. 1,492,969. *J. Soc. Chem. Ind.* **43**, B 503.

TREATMENT AND PURIFICATION OF (MINERAL) OILS AND SPIRITS.—V.L. Oil Processes, Ltd., and O. D. Lucas. Brit. Pat. 214,871. *J. Soc. Chem. Ind.* **43**, B 550. *Chem. Age* **10**, 578.

PURIFICATION OF HYDROCARBONS, PARTICULARLY LIGHTER PETROLEUM FRACTIONS.—H. D. Demoulins and F. H. Garner. Brit. Pat. 216,918. *Chem. Age* **11**, 44.

MAKING EMULSIONS.—C. A. Agthe. Brit. Pat. 210,307. *Chem. Abstr.* **18**, 1724.

EXTRACTING BITUMINOUS MATERIAL FROM SAND.—J. Coogan. U.S. Pat. 1,487,541. *Chem. Abstr.* **18**, 1748. *J. Soc. Chem. Ind.* **43**, B 410.

6. NATURAL GAS.

NATURAL GAS.—G. B. Richardson. *Mineral Resources of the United States*, 1922, Part II., No. II: 31, p. 353.

A UNIQUE WELL.—*Petr. Times* **11**, 782.

California's Natural Gasoline Industry.—C. F. Bevan. *Oil and Gas J.* **23**, (21), 60.

Salient Features of Natural Gas Situation at Columbus, Ohio.—S. S. Wyer. *Oil and Gas J.* **23**, (21), 68.

Natural Gasoline Contracts and other Questions are Discussed.—R. I. Short. Assoc. of Nat. Gas Mfr. *Oil and Gas J.* **23**, (21), 82. *Oil Weekly* **33**, (5), 27. *Oil Trade J.* **15**, (5), 34.

Natural Gas at Baku.—*Oil and Gas J.* **23**, (19), 78.

Carbon Dioxide Well Find in Central Utah.—*Oil and Gas J.* **23**, (19), 78.

Carbon Black Produced from Natural Gas.—G. B. Richardson. *Oil and Gas J.* **23**, (23), 78.

Methods of Making Natural Gasoline Compared.—D. E. Foster. *Nat. Petr. News* **16**, (19), 88.

Natural Gas a Profit Maker for Producer.—D. B. Dow. *Oil Weekly* **33**, (7), 30.

Methods Used by California Operators.—C. J. von Bibra. *Ref. and Nat. Gas. Mfr.* **3**, (5), 13.

Problems We Have Met in Operation and How they were Overcome.—*Ref. and Nat. Gas. Mfr.* **3**, (5), 16.

The Removal of Hydrogen Sulphide from Natural Gas.—L. Logan and G. G. Desy. *Nat. Gas.* **5**, 12. *Chem. Abstr.* **18**, 1560.

Natural Gas Developments during 1923.—E. G. Sievers. *Gas Age-Record* **53**, 635. *Chem. and Met. Eng.* **30**, 878.

Carbon Black Produced from Natural Gas in 1922.—G. B. Richardson. U.S. Geol. Surv. *Mineral Resources of the U.S.*, 1922, Part I., 245; Part II., 353.

Carbon Black's Position in Industry.—C. E. Bowles. *Oil and Gas J.* **23**, (24), 34.

Natural Gas Production and Consumption 1922.—G. B. Richardson. *Oil and Gas J.* **23**, (25), 74.

California Methods in Natural Gasoline.—*Oil and Gas J.* **23**, (25), 92

Natural Gasoline Plant Development.—R. T. Baker. *Oil and Gas J.* **23**, (26), 100.

Stopping Leakage in Handling Natural Gas.—R. A. Cattell. *Oil Weekly* **33**, (11), 37.

Hydrocarbons and their Use in Refrigeration.—A. Henning. Inter. Refrigeration Congress. *Chem. Age* **11**, 9.

Charcoal Process of Gas Extraction Explained.—Gasoline Recovery Corporation. *Ref. and Nat. Gas. Mfr.* **3**, (6), 35.

Industrial Utilisation of Natural Gas.—H. J. Struth. *Nat. Gas*, **5**, (1), 32. *Chem. Abstr.* **18**, 1740.

Natural Gasoline Industry Questions Royalty on Stabilising.—P. Truesdell. *Nat. Petr. News* **16**, (26), 30.

REPORT OF GASOLINE COMMITTEE NATURAL GAS ASSOCIATION OF AMERICA.—R. Chew. *Oil and Gas J.* **23**, (2A), 113.

COMBINES IN ONE OPERATION SEVERAL USES OF NATURAL GAS.—*Oil and Gas J.* **23**, (3A), 70.

EXPERIMENTS SHOW LARGE LOSSES OF NATURAL GAS IN TRANSMISSION.—R. A. Cattell. *Oil and Gas J.* **23**, (3A), 70.

NEW TYPE OF NATURAL GASOLINE PLANT.—R. T. Baker. *Oil and Gas J.* **23**, (3A), 116.

SCOPE OF THE CARBON BLACK INDUSTRY.—E. G. Sievers. *Natural Gas.* **5**, (1), 10. *Chem. Abstr.* **18**, 1883.

COMPRESSION-BLENDING VS. ABSORPTION.—D. E. Foster. *Oil and Gas J.* **23**, (20), 104. *Ref. and Nat. Gas Mfr.* **3**, (4), 13. *Chem. Abstr.* **18**, 1902.

CARBON BLACK.—*Engineering* **115**, 290.

PATENTS.

PROCESS AND APPARATUS FOR PURIFYING GASES.—Koppers Co., Assees. of E. H. Bird. Brit. Pat. 207,488. *J. Soc. Chem. Ind.* **42**, B 459.

PREPARATION OF VOLATILE HYDROCARBONS FROM GAS MIXTURES (NATURAL GAS, PURIFIED ILLUMINATING GAS, ETC.).—Allgem. Vergasungs-Ges. m.b.H. Ger. Pat. 346,112. *J. Soc. Chem. Ind.* **42**, B 502.

PROCESS OF AND APPARATUS FOR MAKING GAS-BLACK.—W. G. Laird, Assr. to H. L. Doherty. U.S. Pat. 1,490,469. *J. Soc. Chem. Ind.* **42**, B 527. *Chem. and Met. Eng.* **30**, 719. *Chem. Abstr.* **18**, 1899.

PROCESS AND APPARATUS FOR REMOVAL OF HYDROGEN SULPHIDE AND OTHER NOXIOUS CONSTITUENTS FROM GASES.—Koppers Co., Assees. of C. J. Ramsburg. Brit. Pat. 210,382. *J. Soc. Chem. Ind.* **42**, B 549.

RECOVERING GASOLINE FROM OIL AND FIELD GAS.—L. V. Warren. U.S. Pat. 1,484,922. *Petr. Age* **13**, (6), 72. *Ref. and Nat. Gas. Mfr.* **3**, (3), 35. *J. Soc. Chem. Ind.* **42**, B 366. *Chem. Abstr.* **18**, 1383.

7. PETROL AND OTHER MOTOR FUELS.

PETROL SUBSTITUTES FOR FRANCE.—*Petr. Times* **12**, 54.

NATURAL GASOLINE IN STRAIGHT RUN PLANT.—W. K. Holmes. *Oil and Gas J.* **23**, (21), 62.

MORE UNIFORM GASOLINE IS BEING MADE.—R. T. Baker. *Oil and Gas J.* **23**, (19), 100.

MARKETERS TOLD STORY OF ETHYL FLUID.—*Oil and Gas J.* **23**, (29), 126.

NATURAL GAS GASOLINE.—G. B. Richardson. *Oil and Gas J.* **23**, (23), 100.

OIL INDUSTRY LIKELY TO TAKE LEAD ON ANTI-KNOCK FUEL.—P. Truesdell. *Nat. Petr. News* **16**, (19), 25.

STABILISED GASOLINE AND ITS ADVANTAGES.—L. F. Bayer. *Oil Trade J.* **15**, (5), 64.

ALCOHOL-GASOLINE FUEL MIXTURES.—H. A. Gardner. *Sugar* **25**, 607. *Chem. Abstr.* **18**, 1374.

BLENDED FUELS FOR AUTOMOTIVE ENGINES.—J. C. Smallwood. *Mech. Eng.* **45**, 577. *Chem. Abstr.* **18**, 1375.

DETONATION IN MOTOR FUELS.—H. Moore. *Chem. Trade J.* **74**, 6. *Chem. Age* **10**, 4. *Chem. Abstr.* **18**, 1375.

FACTORS ENTERING INTO GOOD GASOLINE.—C. A. Wendt. *Oil and Gas J.* **23**, (14), 92. *Chem. Abstr.* **18**, 1382.

THE PRESENCE OF CHLORINE IN MOTOR SPIRITS.—S. Lawson. *Oil Engineering and Finance* **5**, 363.

COMPARATIVE TESTS WITH MOTOR BENZENE, "TETRALITBENZOL," REICHSKRAFTSTOFF AND BENZENE SPIRIT.—F. Hausser, R. Bestehorn and H. Ellerbusch. *Ber. Ges. Kohlentechn.* **4**. *Chem. Abstr.* **18**, 1560.

USE OF BENZINE FROM GAS PRODUCED BY LOW-TEMPERATURE CARBONISATION AS MOTOR FUEL.—F. Hausser, R. Bestehorn and H. Ellerbusch. *Ber. Ges. Kohlentechn.* **4**, 205. *Chem. Abstr.* **18**, 1560.

PRELIMINARY GASOLINE SURVEY.—P. V. Rosewarne. *Canad. Dept. Mines Summary Rept.*, 1922, (605), 218. *Chem. Abstr.* **18**, 1563.

STABILISED GASOLINE AS PRODUCED IN A NATURAL-GASOLINE PLANT.—L. F. Bayer. *Oil and Gas J.* **23**, (15), 32. *Chem. Abstr.* **18**, 1563.

NATURAL-GAS GASOLINE IN 1922.—G. B. Richardson. *U.S. Geol. Surv. Mineral Resources of the U.S.* 1922, Part II., 347.

SYNTHOL, A NEW SYNTHETIC MOTOR FUEL.—F. Fischer and H. Tropsch. *Brenn. Chem.* **5**, 276. *Chem. Zeit.* **48**, 235. *Chem. and Met. Eng.* **30**, 918.

SUCCESS OF PYNOL IN M.C.C. LONDON-EDINBURGH TRIAL.—*Oil News* **15**, 703.

NAPHTHALENE MOTORS.—C. Anguenot. *Bull. Soc. Ind. Mulhouse* **90**, 57. *Chem. Abstr.* **18**, 1741.

THE PROBLEM OF NATIONAL FUEL.—G. Baume. *Ann. chim. anal. chim. applicata* **6**, 97. *Chem. Abstr.* **18**, 1893.

TESTS OF VARIOUS AUTOMOBILES IN URUGUAY WITH "CARBURANTE NACIONAL."—A. E. Goslino. *Anales asoc. quim. Argentina* **11**, 268. *Chem. Abstr.* **18**, 1894.

A NEW MOTOR FUEL.—L. G. Schwalenberg.—*Railroad Red Book* **40**, 1067.

ECONOMIC MOTOR-FUEL VOLATILITY.—S. W. Sparrow. *Bull. Am. Petr. Inst.* **4**, 121.

THE PROGRESS OF ANTI-KNOCK FUELS.—T. Midgley. *Bull. Am. Petr. Inst.* **4**, 141.

PATENTS.

SUBSTITUTE FUEL OIL.—J. J. Kirby, Assr. to General Oil Co. U.S. Pat. 1,488,009. *J. Soc. Chem. Ind.* **43**, B 460. *Chem. Abstr.* **18**, 1743.

SYNTHETIC LIQUID FUEL.—H. A. Jacobs. U.S. Pat. 1,489,763. *J. Soc. Chem. Ind.* **43**, B 460. *Chem. Abstr.* **18**, 1899.

HOMOGENISING LIQUID MIXTURES; FUELS; VARNISHES.—J. D. Riedel Akt.-Ges. Brit. Pat. 208,904. *Chem. Abstr.* **18**, 1539.

MOTOR SPIRIT.—I. Diamond. Brit. Pat. 207,883. *Chem. Abstr.* **18**, 1561.

HYDROCARBONS, ETC.; MOTOR SPIRIT; SOAPS.—C. P. Byrnes. Brit. Pat. 209,128. *Chem. Abstr.* **18**, 1565.

CYCLOHEXANE MOTOR FUEL.—T. Midgley, Assgd. to General Motors Research Corp. U.S. Pat. 1,491,998. *Chem. and Met. Eng.* **18**, 876. *J. Soc. Chem. Ind.* **43**, B 503. *Chem. Abstr.* **18**, 1899.

LIQUID FUEL.—E. H. Records. U.S. Pat. 1,491,275. *J. Soc. Chem. Ind.* **43**, B 503. *Chem. Abstr.* **18**, 1899.

FUEL FOR INTERNAL COMBUSTION ENGINES.—B. H. Morgan. U.S. Pat. 1,495,094.

LIQUID FUEL.—J. F. P. Le Riboisiere. Brit. Pat. 213,948. *Oil Engineering and Finance* **5**, 420.

MOTOR FUEL.—F. E. Lichtenthaeler. U.S. Pat. 1,488,605. *Chem. Abstr.* **18**, 1599.

AIRPLANE MOTOR FUEL.—A. A. Backhaus. Can. Pat. 239,779. *Chem. Abstr.* **18**, 1899.

FUEL MIXTURE FOR INTERNAL-COMBUSTION ENGINES.—W. D. M. Howard. U.S. Pat. 1,490,975. *Chem. Abstr.* **18**, 1899.

8. KEROSENE.

PATENT.

POLISHING COMPOSITION.—R. G. Waring. U.S. Pat. 1,487,632. *Chem. Abstr.* **18**, 1758.

10. LUBRICATION AND LUBRICANTS.

ECONOMICS OF LUBRICATION—SUGGESTIONS FOR A RESEARCH PROGRAMME.—W. F. Parish. *Nat. Petr. News* **16**, (19), 59.

THE MECHANISM OF LUBRICATION. III. THE EFFECT OF OILINESS ON THE BEHAVIOUR OF JOURNAL BEARINGS.—D. P. Barnard, H. M. Myers and H. O. Forrest. *Ind. and Eng. Chem.* **16**, 347. *Chem. Abstr.* **18**, 1383.

SEMI-SOLID LUBRICATING GREASES.—V. Jelinek. *Seifensieder Zeit.* **51**, 6, 22, 58, 73. *Chem. Abstr.* **18**, 1383.

THE TRACTOR AND ITS LUBRICATION.—*Lubrication* **10**, 13.

LUBRICATING OIL CLAIMED BY NEW INVENTION.—*Oil Trade J. Oil Engineering and Finance* **5**, 407.

INVESTIGATION SHOWS MOST MOTOR OIL BEING SOLD IS GOOD OIL.—P. Truesdell. *Nat. Petr. News* **16**, (20), 69.

INDUSTRIAL LUBRICATION.—Waverly Oil Works Co., Pittsburgh, Pa.

GETTING BETTER SERVICE FROM LUBRICATING OILS.—A. F. Brewer. *Ind. Man.* **65**, 13.

PROBLEMS OF LUBRICATION RESEARCH.—M. D. Hersey. *J. Amer. Soc. Naval Eng.* **35**, 648.

SERVICE TESTS OF LUBRICANTS IN INTERNAL COMBUSTION ENGINES.—W. S. James. *Bull. Am. Petr. Inst.* **4**, 132.

DETERIORATION OF TURBINE OIL IN USE.—A. Duckham. *Power* **58**, 707.

PATENTS.

LUBRICANTS AND PACKING CONTAINING HEAT.—O. Anzbock and H. Hoogendoorn. U.S. Pat. 1,485,944. *Chem. Abstr.* **18**, 1384.

LUBRICANTS. J. A. Burton. Brit. Pat. 207,467.

LUBRICANTS.—M. J. Heitman. Brit. Pat. 209,060. *Oil Engineering and Finance* **5**, 230. *Chem. Abstr.* **18**, 1565.

LUBRICANTS.—Plauson's (Parent Co.), Ltd. Brit. Pat. 208,267. *Chem. Abstr.* **18**, 1565

LUBRICANT FOR VEHICLE SPRINGS.—P. H. Bergen. U.S. Pat. 1,486,563. *Chem. Abstr.* **18**, 1565.

RECLAIMING LUBRICATING OIL.—O. Richter and J. L. Deutsche. U.S. Pat. 1,489,278. *Nat. Petr. News* **18**, (24), 85.

LUBRICANT FOR DIES OR TOOLS.—E. G. Behr. U.S. Pat. 1,491,127. *Chem. Abstr.* **18**, 1904.

11. FUEL OIL.

"INFERNO" OIL BURNER.—Gould Burner Co., Shreveport, La.—*Oil and Gas J.* **23**, (21), 74.

CONCERNING HEATERS FOR OIL REFINERIES.—*Oil and Gas J.* **23**, (20), 86.

OIL FOR HOME HEATING IS MOST VALUABLE FUEL USE.—H. L. Doherty. *Oil Trade J.* **15**, (5), 29.

CHECKING LOSSES IN BURNING FUEL OIL.—C. A. Wendt. *Oil and Gas J.* **23**, (17), 104. *Chem. Abstr.* **18**, 1563.

FUELS USED IN THE MANUFACTURE OF ARTIFICIAL PORTLAND CEMENT.—J. Dautrebande. *Chaleur et industrie* **5**, 74. *Chem. Abstr.* **18**, 1737.

COMBUSTION DEVICES FOR LIQUID FUELS.—W. Trinks. *Fuels and Furnaces* **2**, 344. *Chem. Abstr.* **18**, 1738.

THE BURNING OF FUEL OIL IN RAILROAD LOCOMOTIVES.—J. M. Johnston. *Bull. Am. Petr. Inst.* **4**, 61.

PATENT.

PROCESS OF MAKING LIQUID FUEL.—R. A. Butler. Brit. Pat. 213,628. *J. Soc. Chem. Ind.* **43**, B 503.

12. DIESEL OIL AND ENGINES.

ELECTRICITY SUPPLY IN WAR TIME AS AFFECTED BY THE IMPROVEMENTS IN HEAVY OIL ENGINES.—A. H. Dykes and W. T. Townend. Diesel Engine Users' Assoc. *Petr. World* **21**, 244.

A NEW TYPE MARINE ENGINE.—*Daily Telegraph. Petr. World* **21**, 246.

POINTS ON OIL FUELS.—Aufhauser. *Ver. deut. Ingenieure. Petr. World* **21**, 247.

BETHLEHEM OIL ENGINE IS COMMERCIAL SUCCESS.—*Oil Trade J.* **15**, (5), 86.

THE FUTURE OF THE HEAVY OIL ENGINE.—*Financial Rev. Oil Engineering and Finance* **5**, 360.

PROCESSES OF COMBUSTION IN DIESEL ENGINES.—H. v. Wartenberg. *Z. ver. deut. Ing.* **68**, 153. *Chem. Abstr.* **18**, 1560.

BRITISH OIL ENGINES.—W. A. Tookey. Percival Marshall and Co., Ltd., London.

OIL ENGINE EXPERIMENTS.—*Engineering* **115**, 562.

OIL ENGINES REDUCE POWER-PLANT COSTS.—L. H. Morrison. *Power* **58**, 455.

DIESEL ENGINES REDUCE OPERATING COSTS.—*Power* **58**, 689.

COST OF OIL-ENGINED CENTRAL STATIONS.—*Power* **58**, 537.

THE PRESENT-DAY DIESEL ENGINE.—*Power* **58**, 476.

OIL ENGINE MANAGEMENT.—W. A. Tookey. *Petr. World* **21**, 288.

USE OF FUEL UNDER BOILERS AND IN DIESEL ENGINES FOR SHIP PROPULSION.—J. E. Sheedy. *Bull. Am. Petr. Inst.* **4**, 18.

13. PLANT AND MACHINERY.

THERMOSTATIC CONTROL METERS FOR MEASURING LIQUIDS.—*Chem. and Met. Eng.* **30**, 794.

TESTS IN FLOWMETER SHOW GREAT ACCURACY.—J. F. Cunningham. *Chem. and Met. Eng.* **30**, 795.

LONGHORN GAS BURNER GOOD FOR HIGH OR LOW PRESSURE.—*Oil Weekly* **33**, (7), 83.

DOMESTIC OIL BURNER SAFETY REQUIREMENTS.—A. B. Goodspeed. *Oil Trade J.* **15**, (5), 31.

HIGH TEMPERATURE INSULATION.—*Chem. and Met. Eng.* **30**, 874.

CENTRIFUGAL PUMPS IN THE OIL REFINERY.—*Chem. and Met. Eng.* **30**, 915.

FOR HANDLING HOT OIL.—*Oil and Gas J.* **23**, (24), 76.

PORTABLE CRUDE OIL REFINING PLANT.—*Oil and Gas J.* **23**, (24), 124.

AN OIL REFINERY ON WHEELS.—*Chem. and Met. Eng.* **30**, 954.

THE OIL ENGINEER—TUBES, PIPES AND VALVES.—T. Watts-Rockett. *Oil News* **16**, 10, 46.

FRACTIONATION OF COMPLEX MIXTURES AND RECOVERY OF VOLATILE LIQUIDS.—P. C. Lemale. *Chim. et Ind.* **11**, 657. *J. Soc. Chem. Ind.* **43**, B 542.

A PORTABLE REFINING PLANT.—*Petr. Times* **11**, 913.

THE PIRBRIGHT OIL SEPARATOR.—*Petr. Times* **11**, 925.

BULLETIN DESCRIBES OIL VAPOUR PURIFIER IN DETAIL.—*Ref. and Nat. Gas. Mfr.* **3**, (6), 35.

TOPPING PLANT BUILT ON RAILWAY CARS NOW OPERATING IN TEXAS.—W. K. Halbert. *Nat. Petr. News* **16**, (21), 59.

THE OPERATION OF REFINERY TOWERS.—E. H. Leslie. *Oil News* (*U.S.A.*) **12**, (4), 11. *Chem. Abstr.* **18**, 1745.

FRACTIONATING TOWER.—H. E. Widdell. *Oil and Gas News* **14**, (2), 32. *Chem. Abstr.* **81**, 1745.

MODERN PIPE STILLS.—J. Primrose. *Oil and Gas News* **14**, (2), 20. *Chem. Abstr.* **18**, 1745.

FRACTIONAL CONDENSATION AND SEPARATION OF OIL VAPOURS.—D. W. Salisbury. *Oil and Gas News* **14**, (2), 16. *Chem. Abstr.* **18**, 1745.

POWER PLANTS CAN UTILISE EXHAUST GAS.—V. L. Malcev. *Oil Weekly* **33**, (12), 21.

METHOD OF STRAPPING STILLS AND HORIZONTAL TANKS.—H. L. Minister. *Nat. Petr. News* **16**, (20), 87.

USED OIL FIELD BOILERS FORM PART OF DE-HYDRATING PLANT ON LEASE.—L. E. Smith. *Nat. Petr. News* **16**, (25), 89.

OIL AND NATURAL GAS COOLED MECHANICALLY.—*Oil and Gas J.* **23**, (4A), 68.

ORIGINAL IDEAS IN NEW SAFETY SWAB.—*Oil and Gas J.* **23**, (4A), 68.

OIL VAPOUR PURIFIER FEATURES DESCRIBED.—*Oil and Gas J.* **23**, (5A), 56.

CHEMICAL STRUCTURE OF MOTOR ENGINE.—E. Sokal. *Oil and Gas J.* **23**, (5A), 88.

SPECIFIC GRAVITY RECORDER FOR LIQUIDS.—H. Contzon. *Chem. App.* **11**, 57. *Chem. Abstr.* **18**, 1767.

INSULATION OF (PETROLEUM) STILLS.—L. C. Converse. *Nat. Petr. News* **16**, (16), 137.

CARBON DEPOSITS REDUCED ONE THIRD.—V. H. Smith. *Oil and Gas J.* **23**, (20), 32. *Chem. Abstr.* **18**, 1901.

SAVINGS EFFECTED BY USE OF STABILISER IN NATURAL GASOLINE PLANTS.—L. F. Bayer. *Nat. Petr. News* **16**, (18), 24.

AIR COMPRESSOR AND CARGO OIL PUMP.—*Engineering* **115**, 772.

THE FRANKLIN-STEPHENSON OIL-BURNING FURNACE.—*Engineering* **115**, 800.

A NEW VACUUM FUEL OIL BURNER.—*Petr. Times* **11**, 760.

PATENTS.

CONDENSER.—A. K. Whitelaw. U.S. Pat. 1,488,422. *Nat. Petr. News* **16**, (19), 99. *J. Soc. Chem. Ind.* **43**, B 407. *Chem. Abstr.* **18**, 1748. *Chem. Met. Eng.* **18**, 876.

METHOD AND APPARATUS FOR REFINING HYDROCARBONS.—C. R. Burke. U.S. Pat. 1,487,438. *Nat. Petr. News* **16**, (19), 99.

CENTRIFUGAL SEPARATION OF WATER FROM OIL OR SIMILAR LIQUIDS.—E. A. Forsberg. U.S. Pat. 1,485,177. *Chem. Abstr.* **18**, 1353.

A PROCESS AND APPARATUS FOR DISTILLING OIL.—F. S. Woidich. U.S. Pat. 1,490,055. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39. *J. Soc. Chem. Ind.* **43**, B 459. *Nat. Petr. News* **16**, (24), 83. *Chem. Abstr.* **18**, 1903.

EMULSIONS.—H. Bechhold, L. Gutlohn and H. Karplus. Brit. Pat. 213,590. *Chem. Age* **10**, 602.

PROCESS AND APPARATUS FOR THE DISTILLATION OF TARS AND OILS.—E. Liebmann. Ger. Pat. 378,292. *J. Soc. Chem. Ind.* **43**, B 461.

DISTILLING HYDROCARBONS, ETC.—Soc. E. Barbet et Fils et Cie. Brit. Pat. 208,175. *Chem. Abstr.* **18**, 1565.

WAX PRESS.—A. McD. Gray, Assgd. to M. W. Kellogg Co. U.S. Pat. 1,485,391. *Chem. and Met. Eng.* **18**, 876.

PROCESS AND MEANS FOR PREVENTING ONE OF TWO CENTRIFUGALLY SEPARATED LIQUIDS FROM CONTAMINATING THE OTHER.—H. O. Lindgren, Assr. to The De Laval Separator Co. U.S. Pat. 1,493,206.

HEAT-EXCHANGING APPARATUS.—The Griscom-Russell Co., Assees. of C. W. Sward. Brit. Pat. 204,025. *J. Soc. Chem. Ind.* **43**, B 542.

OIL-FIRED FURNACES.—United Oil and Coal Corp., Ltd., and P. Roberts. Brit. Pat. 215,089.

FRACTIONATION TOWER FOR PRESSURE (CRACKING) STILLS AND THE LIKE.—J. E. Bell, Assr. to Sinclair Refining Co. U.S. Pat. 1,489,420. *J. Soc. Chem. Ind.* **42**, B 550. *Nat. Petr. News* **16**, (24), 83. *Chem. Abstr.* **18**, 1768.

PURIFYING APPARATUS FOR LIQUID HYDROCARBON (OILS).—W. Johnson. U.S. Pat. 1,490,325. *J. Soc. Chem. Ind.* **43**, B 550.

FURNACE FOR REVIVIFYING FULLER'S EARTH.—J. Norbeck. U.S. Pat. 1,490,846. *J. Soc. Chem. Ind.* **43**, B 550.

FLOAT-CONTROLLED APPARATUS FOR SEPARATING LIQUIDS OF DIFFERENT SPECIFIC GRAVITIES.—J. E. Swendeman. U.S. Pat. 1,486,936. *Chem. Abstr.* **18**, 1592.

FILTER FOR LIQUID FUELS OR OTHER LIQUIDS.—J. Shateau. U.S. Pat. 1,489,519.

APPARATUS FOR MIXING LIQUID FUEL INGREDIENTS OR OTHER LIQUIDS.—F. E. Lichtenthaeler. U.S. Pat. 1,490,333.

GRAVITY SEPARATION OF OIL AND WATER OR OTHER LIQUIDS OF DIFFERENT DENSITIES.—H. M. Alexander. U.S. Pat. 1,490,794.

OIL GAUGE.—C. D. Eaton. U.S. Pat. 1,413,836.

SEPARATION OF PETROLEUM-OIL SLUDGES.—S. H. Diggs. U.S. Pat. 1,418,781.

14. TESTING, ANALYSIS AND APPARATUS.

RELATION BETWEEN THE FLUIDITY AND THE TEMPERATURE OF LIQUIDS.—H. J. M. Creighton. *Proc. Trans. Nova Scotian Inst. Sci.* **15**, 165.

THE HEATS OF COMBUSTION OF BENZOIC ACID, NAPHTHALENE AND CANE SUGAR.—P. Schapfer and W. Fiorini. *Helv. Chem. Acta.* **6**, 713. *Chem. Abstr.* **18**, 1228.

AMERICAN SOCIETY FOR TESTING MATERIALS TENTATIVE STANDARDS SUBMITTED OR REVISED AT 1923 ANNUAL MEETING.—*Proc. Am. Soc. Testing Materials* **23**, I, 541. *Chem. Abstr.* **18**, 1348.

DETERMINING THE AMOUNT OF GASOLINE OBTAINABLE FROM CRUDE PETROLEUM.—S. E. Campbell. *Oil Age* **21**, (3), 16. *Chem. Abstr.* **18**, 1382.

A METHOD FOR THE ESTIMATION OF THE COLOUR OF OILS.—D. C. Cox. *Proc. Am. Soc. Testing Materials* **23**, II, 416. *Chem. Abstr.* **18**, 1396.

THE DETERMINATION OF THE VISCOSITY OF HIGHLY VISCOUS SUBSTANCES.—E. Berl, M. Isler and A. Lange. *Z. angew. Chem.* **37**, 128. *Chem. Abstr.* **18**, 1405.

ELECTROMETER FOR MEASURING THE RADIOACTIVITY OF GASES FROM OIL AND GAS WELLS.—F. K. Harris. *Proc. Okla. Acad. Sci.* **3**. *Univ. Okla. Bull.* **271**, 131. *Chem. Abstr.* **18**, 1428.

UNITED STATES GOVERNMENT SPECIFICATIONS FOR LUBRICANTS AND LIQUID FUELS AND METHODS FOR TESTING.—*U.S. Bureau Mines Tech. Paper* 323A.

CONDENSER FOR DISTILLING OILS OF WIDE BOILING POINT.—H. N. Calderwood. *Ind. and Eng. Chem.* **16**, 576.

TESTING OF FOAM FOR USE ON FIRES.—C. K. Swift. *Ind. and Eng. Chem.* **16**, 580.

THE SODIUM PLUMBITE OR DOCTOR TEST OF GASOLINES.—B. T. Brooks. *Ind. and Eng. Chem.* **16**, 588.

TENTATIVE STANDARD METHODS OF SAMPLING AND TESTING BITUMINOUS AND OTHER HIGHWAY MATERIALS.—*U.S. Dept. of Agriculture Bull.* 1216. *Oil Paint and Drug Rept.* **105**, (24), 44 B.

DETERMINATION OF ORGANIC VAPOURS IN GAS MIXTURES BY MEANS OF ACTIVE CHARCOAL, PARTICULARLY OF BENZOL IN ILLUMINATING GAS OR COKE-OVEN GAS.—E. Berl and E. Wachendorff. *Z. angew. Chem.* **37**, 205.

ABSORPTION APPARATUS FOR THE DETERMINATION OF ORGANIC VAPOURS IN AIR OR GAS.—R. Kattwinkel. *Brennstoff-Chem.* **5**, 102. *J. Soc. Chem. Ind.* **43**, B 546.

FINDING GASOLINE CONTENT OF CRUDE.—S. E. Campbell. *Ref. and Nat. Gas. Mfr.* **3**, (6), 15.

URGES UNIFORM METHOD OF CORRECTING VOLUME FOR TEMPERATURE.—*Nat. Petr. News* **16**, (21), 91.

(DETERMINATION OF) THE DENSITY OF LIQUID AND SOLID SUBSTANCES.—A. Damiens. *Bull. Soc. Chim.* **35**, 455. *J. Soc. Chem. Ind.* **43**, B 579.

A VISCODENSIMETER.—W. Kopaczewski. *Bull. soc. chim. biol.* **5**, 316. *Chem. Abstr.* **18**, 1591.

A FIELD METHOD AND APPARATUS FOR THE DETERMINATION BY MEANS OF ELECTRICAL CONDUCTIVITY MEASUREMENTS, OF THE CHARACTER OF WATERS LEAKING INTO OIL AND GAS WELLS.—R. T. Elworthy. *Canad. Dept. of Mines Summary Rept.* 605, p. 58. *Chem. Abstr.* **18**, 1746.

CORRECTION OF GRAVITY FOR TEMPERATURE.—W. M. Fraser. *Oil and Gas J.* **23**, (4), 108.

DETERMINATION OF ANHYDROUS SOAP IN A LUBRICATING GREASE.—B. Joachim. *Ind. and Eng. Chem.* **16**, 725.

DIRECTIONS FOR USING PARR OXYGEN BOMB AND ADIABATIC CALORIMETERS.—The Standard Calorimeter Co., East Moline, Ill. *Booklet No.* 101.

THE HEMPEL METHOD FOR DETERMINING THE HEATING VALUE OF GAS.—F. Foerster and E. Grunert. *Brennstoff-Chem.* **5**, 1. *Chem. Abstr.* **18**, 1894.

LIMITATIONS OF END POINT SPECIFICATIONS FOR GASOLINE.—R. O. and H. B. Neal. *Nat. Petr. News* **16**, (16), 123. *Chem. Abstr.* **18**, 1902.

NOVEL, SIMPLE AND UNIVERSAL METHOD FOR THE INVESTIGATION OF LUBRICATING OILS AND BEARING ALLOYS.—R. von Dallwitz-Wegner. *Testing* **1**, 58. *Chem. Abstr.* **18**, 1902.

LABORATORIUMSBUCH FÜR DIE ERDÖLINDUSTRIE.—R. Kissling. Knapp, Halle.

AN EXPERIMENTAL STILL FOR THE DETAILED STUDY OF CRUDE PETROLEUM.—M. B. Cooke. *The Mid-Continent Year Book*, 97.

ABSCHEIDUNG DER ASPHALTENE AUS MINERALÖLEN DURCH CYCLOHEXAN.—M. Jakes. *Chem. Zeit.* **47**, 757.

TESTING RESISTANCE TO EMULSIFICATION.—*Power* **58**, 493.

PATENT.

SPECIFIC GRAVITY DETERMINATIONS.—W. G. Exton. U.S. Pat. 1,488,747. *Chem. Abstr.* **18**, 1779.

15. CRACKING AND HYDROGENATION.

COMPARATIVE ADVANTAGES OF CALORISING.—A. H. Mayo. *Oil and Gas J.* **23**, (13), 96. *Chem. Abstr.* **19**, 1382.

ACTION OF JAPANESE ACID CLAY ON PARAFFIN WAX.—S. Kawai. *J. Chem. Ind.* (*Japan*) **26**, 304. *Chem. Abstr.* **18**, 1382.

VISCOSITIES AND COLD TESTS OF FUEL OILS.—H. Moore. *Oil Engineering and Finance* **5**, 358.

SIMULTANEOUS SKIMMING AND CRACKING.—G. Egloff. *Oil and Gas J.* **23**, (17), 68. *Chem. Abstr.* **18**, 1563.

PYROGENIC DECOMPOSITION OF ACYCLIC HYDROCARBONS.—H. Gault, F. A. Hessel and Y. Altchigjian. *Compt. rend.* **178**, 1562. *J. Soc. Chem. Ind.* **43**, B 500.

CONVERSION OF (SOLID) PARAFFIN BY HEATING UNDER PRESSURE IN THE PRESENCE OF HYDROGEN, METHANE AND OTHER GASES.—H. I. Waterman and J. N. J. Perquin. *Proc. K. Acad. Wetensch.* **27**, 132. *J. Soc. Chem. Ind.* **43**, B 500. *Chem. Abstr.* **18**, 1903.

THE DUBBS PROCESS FOR CRACKING OIL.—*Petr. Times* **12**, 5.

INSTALLS TWO TUBE AND TANK CRACKING UNITS.—J. C. Chatfield. *Nat. Petr. News* **16**, (21), 54.

CATALYTIC DECOMPOSITION OF HEXAHYDRO-AROMATIC AND SATURATED ALIPHATIC HYDROCARBONS. V. Grignard and R. Stratford. *Compt. rend.* **178**, 2149.

DISTILLATION OF GASOLINE UNDER PRESSURE.—J. Pfanhauser.—*Przemysl Chem.* **6**, 341. *Chem. Abstr.* **18**, 1740.

CATALYTIC DECOMPOSITION OF PETROLEUM OILS UNDER THE INFLUENCE OF ALUMINIUM CHLORIDE.—N. D. Zelinsky. *Techn.-Wirtschaftl. Nachr.* **1922**, 193. *Chem. Abstr.* **18**, 1746.

STUDIES IN PYROGENIC DECOMPOSITION OF NAPHTHA OIL. II.—K. Smolenski with Turowicz, Dobrowolski, Liwowski and Teraszkiewicow. *Przemysl Chem.* **6**, 250, 281. *Chem. Abstr.* **18**, 1746.

CRACKING IN CZECHOSLOVAKIA.—*Oil and Gas J.* **23**, (3A), 148.

CROSS CRACKING PROCESS.—J. B. Rathbun. *Petr. Age* **13**, (3), 69. *Chem. Abstr.* **18**, 1901.

CONVERTING SMACKOVER CRUDE INTO GASOLINE.—G. Egloff. *Ref. and Nat. Gas. Mfr.* **3**, (4), 41. *Chem. Abstr.* **18**, 1902.

FERROUS SELENIDE AS A CONTACT CATALYST FOR CRACKING.—T. Midgley and C. A. Hochwalt. *Ind. and Eng. Chem.* **16**, 365. *Chem. Abstr.* **18**, 1382.

Patents.

Continuous Production of Low-Boiling-point Hydrocarbons from Petroleum Oils.—W. R. Hanna. U.S. Pat. 1,419,378

Process for Treating Petroleum.—C. P. Dubbs, Assgr. to Universal Oil Products Co. U.S. Pat. 1,488,325. *Oil and Gas J.* **23**, (23), 98. *J. Soc. Chem. Ind.* **43**, B 460. *Chem. Abstr.* **18**, 1747. *Nat. Petr. News* **16**, (19), 99. *Ref. and Nat. Gas. Mfr.* **3**, (4), 37.

Apparatus for Converting Heavy Hydrocarbons into Lighter Hydrocarbons.—W. F. Muehl. U.S. Pat. 1,485,565. *Nat. Petr. News* **16**, (19), 99. *J. Soc. Chem. Ind.* **43**, B 460.

Process for Distilling and Cracking Oils.—V. T. Smith. U.S. Pat. 1,490,862. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39. *J. Soc. Chem. Ind.* **43**, B 503. *Nat. Petr. News* **16**, (24), 83. *Chem. Abstr.* **18**, 1903.

Obtaining Saturated Hydrocarbons from Crude Petroleum, etc.—A. Schwarz. Brit. Pat. 211,487. *Oil Engineering and Finance* **3**, 341.

Installations and Devices for the Distillation and Depolymerisation of Liquids or Liquefiable Hydrocarbons.—A. A. F. M. Seigle. Brit. Pat. 190,723. *J. Soc. Chem. Ind.* **43**, B 459.

Process and Apparatus for the Molecular Conversion of Hydrocarbon Oils and the Separation of Resultant Products.—G. P. Lewis. Brit. Pat. 213,295. *J. Soc. Chem. Ind.* **43**, B 460. *Chem. Age* **10**, 469.

Apparatus for Converting Heavy Hydrocarbons into Lighter Hydrocarbons.—W. F. Muehl, Assr. to Interstate Refineries, Inc. U.S. Pat. 1,484,958. *J. Soc. Chem. Ind.* **43**, B 460.

Treatment of Petroleum.—L. Clark. U.S. Pat. 1,491,518. *Nat. Petr. News* **16**, (24), 83.

Cracking Hydrocarbons.—S. J. M. Auld. Brit. Pat. 208,569. *Chem. Abstr.* **18**, 1565.

Process of Purifying and Hydrogenating Heavy Mineral Oils, Coal Distillates, Coal Slimes or Other Heavy Hydrocarbons and Raw Products obtained Therefrom.—Internationale Bergin Comp. voor Olie-en Kolen-Chemie and M. Hofsaes. Brit. Pat. 212,661. *J. Soc. Chem. Ind.* **43**, B 503. *Chem. Age* **10**, 495. *Oil Engineering and Finance* **5**, 420.

Process of Refining Oil.—B. V. Stoll. U.S. Pat. 1,492,273. *J. Soc. Chem. Ind.* **43**, B 503. *Nat. Petr. News* **16**, (24), 83. *Chem. Abstr.* **18**, 1903.

Process and Apparatus for Decomposing Hydrocarbon Oils and Water and Recomposing the Products Therefrom.—J. L. Murrie. U.S. Pat. 1,492,305. *J. Soc. Chem. Ind.* **43**, B 503. *Chem. Abstr.* **18**, 1903. *Nat. Petr. News* **16**, (24), 83.

Cracking Liquid Fuels.—A. Helfenstein. Ger. Pat. 381,723. *J. Soc. Chem. Ind.* **43**, B 503.

Process of Treating Petroleum and Petroleum Derviatives.—H. B. Setzler, Assr. to National Refining Co. U.S. Pat. 1,494,191. *J. Soc. Chem. Ind.* **43**, B 550. *Ref. and Nat. Gas. Mfr.* **3**, (6), 39.

ELECTRICALLY HEATED OIL CRACKING APPARATUS.—C. M. Page, Assr. to G. Fabyan. U.S. Pat. 1,494,125. *J. Soc. Chem. Ind.* **43**, B 550. *Ref. and Nat. Gas. Mfr.* **3**, (6), 39.

CRACKING HYDROCARBON OILS.—H. Wolf. Brit. Pat. 215,336. *Chem. Age* **11**, 46.

METHANE.—Farbwerke vörm. Meister, Lucius and Brüning. Brit. Pat. 215,374. *Chem. Age* **11**, 46.

HYDROGENATING HYDROCARBONS.—Chemical Research Syndicate. Brit. Pat. 210,131. *Chem. Abstr.* **18**, 1743.

REFINING HYDROCARBON OILS.—C. R. Burke, Assgnr. to L. P. Burke. U.S. Pat. 1,487,438. *Petr. Age* **13**, (8), 72. *Ref. and Nat. Gas. Mfr.* **3**, (4), 37. *J. Soc. Chem. Ind.* **43**, B 410. *Chem. Abstr.* **18**, 1747.

CRACKING HYDROCARBON OILS.—Power Specialty Co. Brit. Pat. 209,754. *Chem. Abstr.* **18**, 1747.

PREPARING HYDROCARBON PRODUCTS.—C. R. Ewing. Can. Pat. 239,066. *Chem. Abstr.* **18**, 1903.

APPARATUS FOR CRACKING HYDROCARBONS.—M. H. Kotzebue and L. M. Bowman. U.S. Pat. 1,485,083. *Chem. Abstr.* **18**, 1383.

16. INSULATING OILS.

REPORT ON RESEARCHES ON THE CHEMICAL AND PHYSICAL PROPERTIES OF INSULATING OILS.—British Electric and Allied Industries Research Assoc. *J. Inst. Elec. Eng.* **61**, 661. *Chem. Abstr.* **18**, 1383.

INSULATING OILS.—H. Seymour. *Electrician* **82**, 427. *Chem. Abstr.* **18**, 1564.

EFFECT OF METALS ON TRANSFORMER OIL.—H. von der Heyden and K. Typke. *Petroleum* **20**, 320. *Chem. Abstr.* **18**, 1564.

REQUIREMENTS OF TRANSFORMER AND SWITCH OILS.—A. L. Nugey. *Oil News (U.S.A.)* **11**, (18), 24.

PATENT.

PRESERVING MINERAL, ETC. OILS.—British Thomson-Houston Co., Ltd. Brit. Pat. 212,928. *Oil Engineering and Finance* **3**, 341.

17. SHALE AND SHALE OILS.

THE SAND-LIME (CALCIUM-SILICATE) BRICK PROCESS.—D. Brownlie. *Petr. Times* **12**, 75.

SURVEY MADE OF NEW FOUND BRITISH SHALE BEDS.—*Oil Trade J.* **15**, (5), 25.

A NEW DEVELOPMENT IN THE TREATMENT OF OIL SHALES.—R. H. Crozier. *Mining Mag.* **29**, 265. *Chem. Abstr.* **18**, 1382.

THE SHALE-OIL INDUSTRY OF NEW SOUTH WALES.—N. Waterhouse. *Oil Engineering and Finance* **5**, 86, 158. *Chem. Abstr.* **18**, 1382.

THE AUSTRALIAN OIL-SHALES.—D. T. Day. *Oil Engineering and Finance* **5**, 342.

THE SHALES AND BITUMENS IN FRANCE.—*Petr. Times* **11**, 815.

TREATMENT OF OIL SHALE FROM NEW BRUNSWICK BY THE RYAN OIL DIGESTION PROCESS.—A. A. Swinnerton. *Can. Dept. Mines Summary Rept.* 1922 (605), 210. *Chem. Abstr.* **18**, 1563.

CONSTITUTION OF KEROGEN.—J. W. McKinney. *J. Am. Chem. Soc.* **46**, 968. *J. Soc. Chem. Ind.* **43**, B 499.

THE OIL SHALES OF ESTHONIA.—*Petr. Times* **11**, 883.

THE RETORTING OF OIL SHALES.—V. C. Alderson. *Petr. Times* **11**, 918.

OIL SHALE IN FOREIGN COUNTRIES.—V. C. Alderson. *Petr. Times* **12**, 14.

THE OIL SHALES OF TASMANIA—RECENT DEVELOPMENTS.—A. Wade. *Oil News* **16**, 37.

ASSAY REPORT STUDIES OF TEN TYPICAL OIL SHALES.—W. L. Finlay, J. W. Horne, D. W. Gould and A. D. Bauer. *U.S. Bureau Mines Repts. Investigations* 2603.

OIL SHALE. A HISTORICAL, TECHNICAL AND ECONOMIC STUDY.—M. J. Gavin. *U.S. Bureau Mines Bull.* 210 (revised).

FRACTIONAL EDUCTION OF OIL FROM OIL SHALE.—M. J. Gavin and L. C. Karrick. *U.S. Bureau Mines Repts. Investigations* 2588. *Chem. and Met. Eng.* **30**, 980. *Oil and Gas J.* **23**, (20), 94. *Chem. Abstr.* **18**, 1901.

OIL SHALE KEROGEN BY THE FRACTIONATION OF THE PRIMARY BITUMEN IN HIGH VACUUM AND BY ORGANIC EXTRACTIONS.—C. O. Blackburn. *Colo. School Mines Quart.* **19**, 9. *Chem. Abstr.* **18**, 1901.

RELATION OF PEAT TO OIL SHALES.—S. Linker. *Chem. Age* (*N.Y.*) **32**, 63. *Chem. Abstr.* **18**, 1901.

ÜBER DAS VORKOMMEN EINES SEHR TEERREICHEN ÖLSCHIEFERS IN DEUTSCHLAND.—P. K. Breuer and H. Broche. *Brennstoff Chem.* **4**, 200.

EMPIRE RESOURCES IN OIL.—E. H. Cunningham-Craig. *Can. Min. J.* **44**, 982.

POSSIBILITIES FOR IMMEDIATE OIL SHALE DEVELOPMENT.—J. H. Ginet. *Quart. Colo. School of Mines* **18**, (4), 54.

SHALE BIBLIOGRAPHY TO DATE.—*Mountain States Mineral Age* **8**, (Dec.), 35

PATENTS.

PROCESS FOR TREATMENT OF OIL SHALE AND APPARATUS THEREFOR.—G. C. Hackstaff. U.S. Pat. 1,486,243. *Petr. Age* **13**, (8), 72. *Ref. and Nat. Gas. Mfr.* **3**, (4), 37. *J. Soc. Chem. Ind.* **43**, B 410. *Nat. Petr. News* **16**, (19), 99. *Chem. Abstr.* **18**, 1565.

DISTILLING SHALE WITH SOLVENT.—J. Coogan. U.S. Pat. 1,487,541. *Nat. Petr. News* **16**, (19), 99.

RETORT.—O. Stalmann. U.S. Pat. 1,489,905. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39. *Nat. Petr. News* **16**, (24), 84.

PROCESS FOR TREATING OIL SHALE.—J. B. Jenson. U.S. Pat. 1,490,213. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39. *J. Soc. Chem. Ind.* **43**, B 502. *Nat. Petr. News* **16**, (24), 84. *Chem. Abstr.* **18**, 1903.

OIL-SHALE DISTILLATION APPARATUS.—H. Groves and D. E. Lain. U.S. Pat. 1,490,463. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39. *J. Soc. Chem. Ind.* **43**, B 502. *Nat. Petr. News* **16**, (24), 84. *Chem. Abstr.* **18**, 1904.

APPARATUS FOR SEPARATING OIL FROM OIL SHALE.—W. R. Smith. U.S. Pat. 1,490,945. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39. *J. Soc. Chem. Ind.* **43**, B 502. *Nat. Petr. News* **16**, (24), 85. *Chem. Abstr.* **18**, 1904.

DISTILLING OIL SHALE.—D. K. Fairweather. From R. H. Crozier. Brit. Pat. 212,770. *Chem. Age* **10**, 416. *Petr. Times* **11**, 619. *J. Soc. Chem. Ind.* **43**, B 410. *Oil Engineering and Finance* **3**, (5), 341.

APPARATUS FOR EXTRACTING OIL FROM SHALE.—D. J. L. Davis and G. W. Wallace. U.S. Pat. 1,491,290. *Ref. and Nat. Gas. Mfr.* **3**, (5), 39. *J. Soc. Chem. Ind.* **43**, B 503. *Nat. Petr. News* **16**, (24), 85. *Chem. Abstr.* **18**, 1904.

METHOD AND APPARATUS FOR DESTRUCTIVELY DISTILLING PETROLEUM OR MINERAL FROM OIL SHALES, BITUMINOUS COAL AND OTHER HYDROCARBONACEOUS MATERIAL.—A. Stalli. Brit. Pat. 213,046. *J. Soc. Chem. Ind.* **43**, B 459. *Chem. Age* **10**, 445.

OIL SHALE RETORT.—J. B. Jenson. U.S. Pat. 1,493,880. *J. Soc. Chem. Ind.* **43**, B 550. *Ref. and Nat. Gas Mfr.* **3**, (6), 39.

DISTILLATION OF FUELS.—The Fuel Recovery Syndicate, Ltd., and N. J. Bowater. Brit. Pat. 217,041. *Chem. Age* **11**, 44.

HYDROCARBON OIL VAPOURS AND APPARATUS THEREFOR.—F. Lamplough. Brit. Pat. 216,922. *Chem. Age* **11**, 44.

APPARATUS FOR DISTILLING OIL FROM SHALE OR SIMILAR MATERIALS.—H. L. Brown. U.S. Pat. 1,487,836. *Chem. Abstr.* **18**, 1748.

DISTILLING HYDROCARBONS FROM OIL SHALE OR SIMILAR MATERIAL.—C. B. Wisner. U.S. Pat. 1,490,357. *Chem. Abstr.* **18**, 1903.

18. LIGNITES AND COALS AND THEIR PRODUCTS.

THE BEHAVIOUR OF MONTAN WAX TOWARD DISTILLATION.—J. Marcusson. *Zeits. f. angew. Chem.* **37**, 35. *Chem. techn. Uebersicht* (March 29), 52. *Chem. and Met. Eng.* **30**, 796.

THE OXIDATION OF LIGNITE GAS OIL WITH OZONE.—F. Evers. *Z. angew. Chem.* **37**, 116. *Chem. Abstr.* **18**, 1269.

CLARIFICATION OF EFFLUENTS IN THE LIGNITE INDUSTRY.—H. Bahr and K. Kather. *Braunkohle* **21**, 485. *J. Soc. Chem. Ind.* **42**, 877A. *Chem. Abstr.* **18**, 1378.

LOW TEMPERATURE TAR OBTAINED FROM THE ZECHE FÜRST HARDENBERG COAL, AND IN PARTICULAR, ITS CONTENT OF BENZENE, PHENOL AND ACETONE.—F. Schütz, W. Buschmann and H. Wissenbach. *Ber.* **57**, 619. *J. Soc. Chem. Ind.* **43**, B 460.

A Successful Low-temperature Distillation Process.—H. Holzwarth. *Coal Industry* **7**, 112. *Chem. Abstr.* **18**, 1561.

Where Low-temperature Distillation Stands.—C. H. S. Tupholme. *Combustion* **10**, 57. *Chem. Abstr.* **18**, 1561.

Low Temperature Carbonisation.—S. N. Wellington and W. R. Cooper. C. Griffin and Co., Ltd., London.

Using Internal Heating for Low-temperature Carbonisation.—C. H. S. Tupholme. *Chem. and Met. Eng.* **30**, 861.

Low-temperature Carbonisation.—C. H. Lander and R. F. McKay. Ernest Benn, Ltd., London.

Formation of Ceresin Hydrocarbons from Montan Wax.—J. Marcusson. *Z. angew. Chem.* **37**, 413.

Summary of British Low-temperature Carbonising Methods.—C. H. S. Tupholme. *Chem. and Met. Eng.* **31**, 1019.

Low-temperature Carbonisation.—A. McCulloch. *Chem. Trade J.* **74**, 220. *Chem. Abstr.* **18**, 1740.

Test Result from Low-temperature Carbonisation.—C. H. S. Tupholme. *Chem. Met. Eng.* **30**, 397. *Chem. Abstr.* **18**, 1740.

Low-temperature Carbonisation of South African Coals.—P. N. Lategan. *S. Afr. J. Ind.* **6**, 609. *Chem. Abstr.* **18**, 1740.

Cast-iron Retorts for Low-temperature Carbonisation.—C. H. S. Tupholme. *Chem. Met. Eng.* **30**, 471. *Chem. Abstr.* **18**, 1740.

The Resources in Lignite of the Herault and Aude Districts, France.—H. Pagezy. *Ann. mines* [12], **4**, 341. *Chem. Abstr.* **18**, 1804.

Treatment of Lignite and of Peat.—M. Migeon. *Chim. et Ind.* **11**, 248. *Chem. Abstr.* **18**, 1893.

Low-temperature Carbonisation, especially of Lignite.—C. Berthelot. *Bull. soc. encour. ind. nat.* **136**, 44. *Chem. Abstr.* **18**, 1895.

Some Rotary Low-temperature Carbonisation Retorts Installed in the Ruhr.—E. Davin. *Mat. grasses* **16**, 6698, 6726. *Chem. Abstr.* **18**, 1896.

Die Volkswirtschaftliche Bedeutung der sachsisch-thuringischen Braunkohlenteer-und Montan-wachsindustrie. — W. Grosse Knapp, Halle.

Low-temperature Carbonisation of Coal.—D. Brownlie. *Power* **58**, 603.

Patents.

Dry Distillation, De-gasification or Gasification of Solid Fuels and the Like.—O. Hellman. Brit. Pat. 214,675. *Chem. Age* **10**, 577.

Purifying Brown-coal Wax.—E. von Boyen. Brit. Pat. 209,389. *Chem. Abstr.* **18**, 1562.

Destructive Distillation.—A. S. Ramage. Brit. Pat. 214,222. *Chem. Age* **10**, 629.

Refining (Low-temperature Tar) Oils.—Gelsenbuchner Bergwerks A.-G. Abteil. Schalke and F. Scuhtz. Ger. Pat. 288,547. *J. Soc. Chem. Ind.* **43**, B 367.

Carbonisation of Fuel such as Coal, Lignite and the Like.—W. E. Davies. Brit. Pat. 213,040. *J. Soc. Chem. Ind.* **43**, B 500.

Process and Apparatus for Heating Rotary Kilns (for Coal Distillation).—H. Holzwarth, Assr. to Lignite Coal and By-Products Corp. U.S. Pat. 1,488,248. *J. Soc. Chem. Ind.* **43**, B 501.

Recovery of Oil contained in Agglomerated Substances obtained by the Churning of Pulverised Substances (Coal) in a Bath of Water Mixed with Oil.—Soc. de Recherches et de Perfectionnements Industriels and E. B. G. Bascou. Brit. Pat. 198,346. *J. Soc. Chem. Ind.* **43**, B 548.

Coking and Carbonising Processes and Apparatus, more particularly for Low-temperature Carbonisation.—H. Koppers. Brit. Pat. 203,444. *J. Soc. Chem. Ind.* **43**, B 548.

Distilling Solid Materials.—M. C. J. E. de Loisy and E. Grauce. Brit. Pat. 210,402. *Chem. Abstr.* **18**, 1743.

Process for Producing Mixtures of Oil and Coal.—E. Berl. Brit. Pat. 195,406. *J. Soc. Chem. Ind.* **43**, B 500.

19. Pitch, Asphalt and Bitumen.

Illinois Tests in Oiling Roads Suggest Methods of Preparations.—*Oil and Gas J.* **23**, (22), 80.

Consistency of Road Tars.—D. C. Broome. *J. Soc. Chem. Ind.* **43**, 25T. *Chem. Abstr.* **18**, 1373.

A Crude Oil from Syrian Bituminous Limestone.—L. Boisselet and A. Naegellen. *Mat. grasses* **16**, 6693. *Chem. Abstr.* **18**, 1381.

Using Petroleum Pitch.—E. Donath. *Petroleum* **20**, 47. *Chem. Abstr.* **18**, 1388.

Points to Consider in the Successful Application of Road Oil.—F. W. Padgett. *Nat. Petr. News* **16**, (12), 87. *Chem. Abstr.* **18**, 1563.

The Bituminous Sands of Alberta.—S. C. Ells. *Petr. Times* **11**, 842.

United States Government Specification for Asphalt-saturated Rag Felt for Roofing and Waterproofing.—*U.S. Bureau Standards Circ.* 161.

Asphalt and Some of its Uses.—*Petr. Times* **12**, 16.

Bentonite Helps Solve Problem in Grinding Asphalt.—H. S. Spence. *Chem. and Met. Eng.* **30**, 986.

U.S. Government Master Specification for Surfacing Materials for Bituminous Built-up Roofing.—*U.S. Bureau Standards Circ.* 158,

THE CONSTITUTION OF ASPHALT.—F. J. Nellensteyn. *Chem. Weekblad* **21**, 42. *Chem. Abstr.* **18**, 1746.

ILLINOIS COUNTIES JOIN STATE IN EXPERIMENTAL STUDY OF OILED ROADS.—H. F. Clemmer and F. L. Sperry. *Mun. and County Eng.* **65**, 97.

EFFICIENCY IN THE APPLICATION OF ASPHALT FILLER.—J. F. Gallagher. *Mun. and County Eng.* **64**, 37.

THE ADVANTAGES OF STANDARD SPECIFICATIONS FOR BITUMINOUS MATERIALS.—P. Hubbard. *Good Roads* **64**, 67.

MAINTENANCE OF MACADAM ROADS WITH BITUMINOUS MATERIALS.—H. S. Perry. *Mun. and County Eng.* **64**, 162.

HOT-MIX ASPHALT-SAND ROADS.—V. M. Pierce. *Eng. News-Record* **90**, 154.

PATENTS.

BITUMINOUS COMPOSITIONS.—F. J. Wake and D. D. Spence. Brit. Pat. 208,879. *Chem. Abstr.* **18**, 1559.

BITUMINOUS COMPOSITIONS.—R. Tyler. Brit. Pat. 208,770. *Chem. Abstr.* **18**, 1559.

PREPARATION OF COLLOIDAL DISPERSIONS OF ASPHALT OR PITCH.—Plauson's Forschingsinst. G.m.b.H. Ger. Pat. 390,434. *J. Soc. Chem. Ind.* **42**, B 503.

ASPHALTCOATED SHEET MATERIAL.—H. H. Robertson Co. Brit. Pat. 209,727. *Chem. Abstr.* **18**, 1737.

ARTIFICIAL ASPHALTS.—C. L. V. Zimmer and E. Fränkl. Brit. Pat. 210,343. *Chem. Abstr.* **18**, 1748.

COATED WATERPROOF SHEETING.—L. Kirschbraun. U.S. Pat. 1,489,254. *Chem. Abstr.* **18**, 1892.

20. PARAFFIN, OZOKERITE, VASELINE.

SAMPLES OF WHITE VASELINE NOT CHANGING COLOUR ON EVEN PROLONGED CONTACT WITH SULPHURIC ACID.—F. Richard. *J. pharm. chim.* **29**, 233. *Chem. Abst.* **18**, 1732.

PATENT.

WATERPROOFING TEXTILES.—J. C. Grant. Brit. Pat. 210,865. *Chem. Abstr.* **18**, 1757

21. ORIGIN OF PETROLEUM.

THE ORIGIN OF PETROLEUM.—G. W. Halse. *Nature* **112**, 761. *Chem. Abstr.* **18**, 1451.

ORIGIN OF NORTH WESTERN GERMAN OIL.—K. Hummel. *Petroleum* **20**, 115. *Chem. Abstr.* **18**, 1452.

"MINERAL OIL" OF ORGANIC ORIGIN.—*Manchester Guardian. Oil Engineering and Finance* **5**, 398.

22. PHYSICAL PROPERTIES OF PETROLEUM AND ITS PRODUCTS.

SPECIFIC HEATS OF LUBRICATING OILS.—E. H. Leslie and J. C. Geniesse. *Ind. and Eng. Chem.* **16**, 582.

THE SPECIFIC HEATS OF CERTAIN ORGANIC LIQUIDS AT ELEVATED TEMPERATURES.—J. W. Williams and F. Daniels. *J. Am. Chem. Soc.* **46**, 903. *Chem. Abstr.* **18** 1605.

DEPENDENCE OF VISCOSITY UPON TEMPERATURE.—E. Oelschläger. *Z. angew. Chem.* **37**, 208. *Chem. Abs.* **81**, 1903.

23. CHEMISTRY OF PETROLEUM.

VANADIUM IN PETROLEUM ASH.—W. H. Thomas. *Petr. Times* **12**, 58

PETROLEUM AS RAW MATERIAL FOR SOAP MAKING.—*Petr. Times* **12**, 74.

SULPHUR CONTENT OF PETROLEUM.—N. A. C. Smith and D. D. Stark. *U.S. Bureau Mines Repts. Investigations* 2582. *Petr. Times* **11**, 653, 724. *Petr. World* **21**, 226. *Oil Weekly* **33**, (8), 32.

OXIDATION OF HYDROCARBONS TO FORMALDEHYDE.—R. Schönfelder. *Ber. Ges. Kohlentechnik* **1923**, 247. *Chem. Abstr.* **18**, 1271.

MANUFACTURE OF TRINITROTOLUENE FROM ASSAM AND BURMA PETROLEUM.—E. R. Watson. *J. and Proc. Asiatic Soc. Bengal.* **18**, (6) *Chem. Abstr.* **18**, 1389.

THE ELEMENTS ASSOCIATED WITH PETROLEUM.—J. E. Hackford. *Oil Engineering and Finance* **5**, 344.

THE OXIDATION OF PETROLEUM BY MEANS OF AIR.—B. Tütünnikoff. *Z. angew. Chem.* **37**, 300.

THE BLOWING OF PETROLEUM RESIDUES AND TARS.—J. Marcusson and M. Picard. *Chem. Zeit.* **48**, 338.

CONSTITUTION OF MELENE.—J. Marcusson and F. Böttger. *Ber.* **57**, 633. *J. Soc. Chem. Ind.* **43**, B 457.

CHEMICAL NATURE OF THE NAPHTHENIC ACIDS.—O. Aschan. *Ber.* **57**, 636; *J. Soc. Chem. Ind.* **43**, B 458.

RELATION BETWEEN LOW-TEMPERATURE TAR, COKE-OVEN TAR AND PETROLEUM.—F. Schutz. *Ber.* **57**, 623. *J. Soc. Chem. Ind.* **43**, B 460.

THE CALORIFIC VALUE OF ORGANIC SUBSTANCES.—D. N. Konovalov. *J. Russ. Phys. Chem. Soc.* **50**, 81. *Chem. Abstr.* **18**, 1420.

DEHYDROGENATION PROCESSES IN THE PRESENCE OF CATALYSERS.—J. K. Pfaff and R. Brunck. *Ber.* **56**, B 2463. *Chem. Abstr.* **18**, 1465.

Velocity of Oxidation of Paraffin Wax. I.-IV.—F. Francis, W. P. Millard, C. H. Rutt, C. M. Watkins, R. W. Wallington and C. P. Garner. *J. Chem. Soc.* **125**, 381. *Chem. Abstr.* **18**, 1563.

The Volatile Colouring Matter in Cracked Gasolines.—B. T. Brooks and H. O. Parker. *Ind. and Eng. Chem.* **16**, 587.

Combustion of Fuels in Internal-combustion Engines.—W. Ostwald. *Auto-Tech.* **13**, 9. *Chem. Zentr.* **95**, I, 2038. *J. Soc. Chem. Ind.* **43**, B 500.

Some Organic Compounds Usually Associated with Crude Petroleum Oil.—J. E. Hackford. *Oil Engineering and Finance* **5**, 405.

Refining with Sulphuric Acid.—F. Schutz. *Petroleum* **20**, 317. *Chem. Abstr.* **18**, 1745.

Production of Ammonia from Petroleum.—R. Cross. *Oil and Gas News* **14**, (1), 14. *Chem. Abstr.* **18**, 1746.

Secondary Alcohols from Petroleum.—L. M. Fanning. *Oil and Gas J.* **24**, (3), 66.

Patents.

Obtaining Products (Drying Oils) from Chlorinated Hydrocarbons.—H. A. Gardner. U.S. Pat. 1,484,018. *J. Soc. Chem. Ind.* **43**, B 434. *Chem. Abstr.* **18**, 1194.

Halogenation of Hydrocarbons and their Derivatives.—H. T. Tizard, D. L. Chapman and R. Taylor. Brit. Pat. 214,293. *J. Soc. Chem. Ind.* **43**, B 577. *Chem. Age* **10**, 545.

Electrolytic Oxidations.—G. Plauson. U.S. Pat. 1,485,706. *Chem. Abstr.* **18**, 1617.

Catalytic Oxidation of Hydrocarbons and other Organic Substances.—A. Mittasch, E. Willfroth and O. Balz. U.S. Pat. 1,487,020. *Chem. Abstr.* **18**, 1672.

Alcohol from Cracked Petroleum.—C. Ellis and M. J. Cohen. U.S. Pat. 1,486,646-7. *Chem. Abstr.* **18**, 1748.

24. Oil and Petrol Gas.

Patent.

Carburetting Water Gas with Heavy Oils.—O. B. Evans, J. A. Perry and J. B. Eichengreen. U.S. Pat. 1,493,458. *Chem. and Met. Eng.* **30**, 916.

25. Miscellaneous.

Oil and Petroleum Manual, 1924.—W. R. Skinner. Walter E. Skinner, London.

Synonyms for Oil and Oil Products in Various Countries.—*Petr. World* **21**, 251.

PREPARATION OF LIQUID FUEL RESEMBLING PETROLEUM BY DISTILLING THE CALCIUM SOAP OF SOYA BEAN OIL. II.—M. Sato. *J. Chem. Ind. (Japan)* **26**, 297. *Chem. Abstr.* **18**, 1375.

SOME NOTES ON BENZINE SOAPS.—R. G. Thomas. *J. Soc. Dyers Colourists* **40**, 45. *Chem. Abstr.* **18**, 1398.

THE ECONOMICS OF THE OIL INDUSTRY.—R. W. Cohen. *Petr. Times* **11**, 793, 861, 901. *Oil News* **15**, 620.

HANDLING LAND AND LEASE DEPARTMENTS.—J. E. Pew. *Oil Weekly* **33**, (3), 27.

QUARTER MILLION HOMES BURNING OIL.—L. M. Fanning. *Oil and Gas J.* **23**, (26), 32.

VALUATION OF OIL AND GAS LAND.—R. W. Brown. McGraw-Hill Publishing Co., London.

PETROLEUM FROM PEANUT OIL.—A. Mailhe. *Chaleur et industrie* **5**, 3. *Chem. Abstr.* **18**, 1744.

TO-MORROW'S POSSIBILITIES IN RESEARCH.—H. F. Bain. *Oil and Gas J.* **24**, (3), 58.

RECENT PROGRESS IN THE FIELD OF FUELS AND FUEL TECHNOLOGY.—R. T. Haslam and E. W. Thiele. *Ind. and Eng. Chem.* **16**, 749.

DIE FLUSSIGEN BRENNSTOFFE, IHRE GEWINNUNG, EIGENSCHAFTEN UND UNTERSUCHUNG.—L. Schmitz. J. Springer, Berlin.

ERRATA.

Jnl. 43, p. 130A, l. 11, *for* "Tupholme" *read* "Kenshole."

Abstracts.

Compiled by S. F. Birch, S. Bowman, F.I.C., J. E. Marshall Hall, A.R.S.M., H. Moore, M.Sc., W. S. Norris, F. G. P. Remfry, B.A., D.Sc., A.I.C., G. Sell, T. A. Smith, B.Sc., F.I.C., and W. G. Weeks, A.R.S.M., A.R.C.S., F.G.S.

General.

Adsorption and Surface Tension at Liquid-Liquid Interface. J. Howard Mathews and Alfred J. Stamm. *J. Amer. Chem. Soc.*, 1924, **46**, 1071–1079.

The authors have measured the interfacial tensions against water of mixtures of dimethylaniline and (i) heptane (ii) benzene. The results show that an addition of the constitutent of lower surface tension causes a great lowering of interfacial tension, due to the adsorption of the added constituent at the surface; but the addition of the constituent of higher interfacial tension produces a much smaller effect, since most of it passes to the interior of the drop. Gibbs' equation was applied to the experimental data, after making the assumptions that (i) for non-associated or non-dissociated binary mixtures the surface tension would follow the mixture law were it not for the concentration effect at the interface (ii) concentration relationships can be used down to thicknesses of molecular dimensions. It was then found that (*a*) adsorption is one molecule thick until a complete surface layer is formed, (*b*) a complete layer is only produced at high concentrations, (*c*) the molecular thicknesses and cross-sections are of the same order as those found by other workers. W. S. N.

The Determination of Surface Tension with very small Volumes of Liquid, and the Surface Tensions of Octanes and Xylenes at Several Temperatures. Theodore W. Richards, Clarence L. Speyers and Emmett K. Carver. *J. Amer. Chem. Soc.*, 1924, **46**, 1196–1207.

The surface tension of a very small volume of liquid is measured from the difference in capillary rise in two narrow tubes of different diameters. The method for calculating the correction to the rise in the wider of these tubes is given. The apparatus is standardised using pure, air-free water. Figures are given for the surface tensions, each at three temperatures, of water, *n*-octane, *a*-methylheptane, *s*-di-*iso*-propylethane, *o*-xylene, *m*-xylene, *p*-xylene, and ethylbenzene. Equations are given for calculating the surface tension at any intervening temperature. W. S. N.

Adsorption by Activated Sugar Charcoal. I. Proof of Hydrolytic Adsorption. Elroy J. Miller. *J. Amer. Chem. Soc.*, 1924, **46**, 1150–1158 (*cf.*, *ibid.*, 1922, **44**, 1866; 1923, **45**, 1106).

The adsorption of salts from aqueous solutions by pure activated sugar charcoal is accompanied by hydrolysis; the acid formed is adsorbed by the charcoal, whilst the free base remains in solution. The proof is

based on the following facts: (i) The purity of the charcoal used precludes the possibility that the alkalinity of the treated saline solution is derived from impurity in the charcoal. (ii) The base liberated in the solution is equivalent to the acid obtained by extracting the charcoal after adsorption. (iii) The acid so recovered is identical with that from which the original salt was derived. Moreover, the amount of decomposition of the alkali salts of various acids varies in the same order as the adsorbability of the acids themselves. Apparently potassium benzoate, but not potassium chloride, is also, to some extent, adsorbed non-hydrolytically. W. S. N.

ANALYSIS OF TWO NEW CZECHOSLOVAKIAN CRUDE PETROLEUMS. M. I. Chorkaveis and D. Prunet, *Chimie et Industrie*, II, 1924, 260.

The Moravian oil obtained from the Eocene formation near Hodonin contains no paraffin waxes or asphalts and possesses the following physical constants: S.G. at 15° 0·9340, at 20° 1.5083, Viscosity (Engler) 8·54 at 20°, Flash Point 109°, Set point below −18°. The Sulphur content is 0·20 per cent. Distillation tests gave: I.B.P. 203°, below 250° 6·4 per cent. (S.G. 0·877), between 250° and 300° 23·5 per cent. (S.G. 0·902), and a residue 69·5 per cent. (S.G. 0·949), having a set point below 15°. The composition is similar to the Miocene oils of Gbely and Hodonin. The second oil, from Mikova, was also obtained in an Eocene formation and gave: S.G. at 15° 0·824, at 20° 1·444, Viscosity (Engler) 1·22 at 20°, Flash Point below 0° and a set point below −18°. Analysis showed that the acidity was nil, paraffin wax 1·09 per cent., asphalts, insoluble in alcohol and ether, 0·66 per cent. and Sulphur 0·242 per cent. Distillation tests gave: I.B.P. 42°, below 130° 30·05 per cent. (S.G. 0·744), 130–150° 6·30 per cent. 150–250° 22·09 per cent. (S.G. 0·810), 250–300° 14·05 per cent. (S.G. 0·858) and a residue (26·45 per cent.) setting at 11°. S. F. B.

CATALYTIC ACTION OF NICKELISED ALUMINIUM HYDROXIDE. W. Zelinsky and W. Kommarewsky. Ber, 57 (B), 1924, 667–669.

The catalyst appears to be a very fine deposit of nickel on an aluminium hydroxide of the approximate composition $Al_2O_3(OH)_2$. It is prepared by adding a solution of aluminium nitrate in the necessary amount of caustic soda to a solution of nickel nitrate, the whole then being saturated with carbon dioxide. Unignited pure aluminium oxide is added and the precipitate thoroughly washed. After drying at 120° it is reduced in hydrogen at 300–330° and is then ready for use. Unlike pure nickel it does not decompose benzene and *cyclo*hexane into methane in the presence of hydrogen. Considerable differences between this catalyst and that of Pfaff and Brunck (Ber. 56, (B) 2463–2464) have been observed. It closely resembles platinum and palladium in the manner in which it readily dehydrogenates *cyclo*hexane derivatives, but is less drastic in its action than nickel alone. S. F. B.

MONOMOLECULAR FILMS OF SODIUM RICINOLEATE IN EMULSIONS. P. A. van der Meulen and Wm. Rieman 3rd. *J. Am. C. S.*, 1924, 46, 877.

Emulsions of the oil-in-water type with a solution of phenol in toluene as the oil phase and sodium ricinoleate as the emulsifying agent have been examined. From analyses of the original emulsion and the upper and lower layers obtained by centrifuging a dilute solution of the emulsion, the writers were able to calculate the soap in the interface to within 10 per cent. Measurements of the sizes of the globules were made by

two independent methods, one using a haemacytometer treated with stearin and the other by means of a micrometer eyepiece. The average result from the two methods was taken and used to calculate the average area occupied by a molecule of soap in the interface. The figures obtained showed that these areas were functions of the concentration of the soap and agree with the theory that the soap film is monomolecular.

S. F. B.

"KOSMACZ" PETROLEUM. J. W. Florjan. *Przemysl Chem.* **6**, 229, 231.

The average yields obtained on distillion are as follows: benzene 8·94 per cent., kerosene 17·80 per cent., gas oil 20·20 per cent., various grades of lubricating oils totalling 29·80 per cent., asphalt 8·0 per cent. and 7·80 per cent. of waste products. The distillation losses average 6·66 per cent.

S. F. B.

NAPHTHENIC ACIDS IV. METALLIC SALTS OF NAPHTHENIC ACIDS. Y. Tanaka, K. Horiuchi and G. Oyama. *J. Chem. Ind.*, Japan, 1923, **26**, 1190–1203.

An investigation of the naphthenic acids and their salts derived from the waste lyes obtained in refining Kurokawa petroleum. These acids have been found to consist chiefly of the trideca-, the tetradeca- and the pentadecanaphthene-carboxylic acids. A study of their solubilities showed that with decreasing molecular weight, the solubility increased. Lead, manganese, chromium, aluminium, calcium, magnesium and zinc salts were prepared and are described. Of these manganese tridecanaphthene-carboxylate is a pink powder, insoluble in hot and cold water, but slightly soluble in absolute alcohol and ether. The tetradecanaphthene-carboxylate melts at 61–63°. All three lead salts were obtained as vitreous solids melting between 110° and 118°. Both the lead and manganese salts have a drying action on linseed oil. A marked waterproofing action was shown by the aluminium salts.

S. F. B.

COMPOSITION OF JAPANESE PETROLEUM I. S. Komatsu and S. Kusumoto. *Mem. Coll. Sci. Kyoto*, 1924, **7**, 77–84.

The authors have shown that Japanese petroleum from Nishiyama, Echigo, is almost completely composed of polymethylene hydrocarbons and naphthenes. On fractionation the following proportions were obtained: below 150°, between 150° and 300° and above 300°, 23·2, 47·3 and 29·5 per cent. respectively. The first of these was redistilled and gave a fraction boiling between 70° and 90°. It was treated with fuming sulphuric acid, followed by a mixture of nitric and sulphuric acids and finally, after washing with dilute potash, dried over sodium and refractionated. The oil, freed in this manner from aromatics and unsaturated hydrocarbons, exhibited two maxima in the temperature-weight of distillate curve, one at 72° and the other at 80–81°. The first hydrocarbon, boiling at 72° corresponds in all its physical properties with methyl-*cyclo*pentane b.p. 71°–72° $d\,\frac{25}{4}$ 0·7295, $n\,\frac{25}{d}$ 1·3965 and was identified with it by chemical analysis and by the formation of glutaric, succinic, acetic and oxalic acids on oxidation by nitric acid. The second hydrocarbon, boiling at 80°–81°, possessed all the physical properties and constants of cyclo-hexane b.p. 80°–81° $d\,\frac{25}{4}$ 0·765, $n\,\frac{25}{d}$ 1·414 with which it was shown to be indentical by the formation of nitrobenzene on nitrating its dehydrogenation product.

S. F. B.

THE COMPOSITION OF JAPANESE PETROLEUM II. Shigeru Komatsu and Naozo Tanaka. *Mem. Coll. Sci., Kyoto Imp. Univ.*, 1924, **7**, 143–146.

Benzene has been identified as a constitutent of Nishiyama petroleum by the preparation of benzene sulphonic acid from the sludge obtained when the 70–90° fraction is treated with fuming sulphuric acid. The benzene sulphonic acid was characterised by conversion into phenol and phenyl benzoate successively.

Hexane was isolated from the 40–75° fraction by seven fractionations using a two-column dephlegmator.

The final fraction b.p. 66·5–71, after oxidation with nitric acid, was washed free from acid and refractionated four times over metallic sodium at ordinary pressure and three times at 749 mm. In this way a fraction b.p. 67·5–68·5° was obtained which gave on analysis: carbon 83·05 per cent. and hydrogen 15·93 per cent. and had d^{25} 0·66863. S. F. B.

THE SPECIFIC HEATS OF CERTAIN ORGANIC LIQUIDS AT ELEVATED TEMPERATURES. John W. Williams and Farrington Daniels. *J. Am. C. S.*, 1924, **46**, 903.

An adiabatic calorimeter for measuring the specific heats of liquids accurately at elevated temperatures is described. The results obtained between 30° and 80° for benzene, toluene, ethylbenzene, *o*-, *m*-, *p*-xylenes, *iso*-propyl, ethyl, *iso*-amyl, *n*-butyl, *iso*-butyl alcohols, nitrobenzene, chloroform, carbon tetrachloride and heptane are recorded as graphs and as empirical equations. Other physical properties related to the heat capacities are also given. The heat capacity per cubic centimeter for unassociated liquids is a constant, approximately 0·35 calories per degree at room temperatures and slightly more at higher temperatures. Values much above this point to association of the molecules of the liquid, while irregularities in the specific heat-temperature curves indicate a change in the equilibrium between different kinds of molecules in the liquid. S. F. B.

DEHYDROGENATION PROCESSES IN THE PRESENCE OF CATALYSTS. J. K. Pfaff and Richard Brunck. *Ber.*, 1923, **56** (B) 2463–2464.

The authors have found that the palladium black, used by Zelinsky in his dehydrogenation method for distinguishing between *cyclo*hexane and other cyclic paraffins, can be replaced by a much less expensive nickel catalyst. This they prepared by mixing solutions of sodium aluminate and nickel nitrate, the precipitation beong completed by means of carbon dioxide. The paste so obtained, is mixed with pure dry alumina, filtered, washed until free from soda and dried. Finally it is reduced by hydrogen at 320°. This catalyst hydrogenates benzene to *cyclo*hexane quite smoothly at 180°–200°, but when *cyclo*hexane vapour mixed with a large excess of hydrogen is passed over it up to, and in the neighbourhood of 500°, dehydrogenation occurs to a very slight extent only. Pure lignite tar oil, b.p. 80°–150° was readily reduced by it at 180°–200° but when an attempt was made to dehydrogenate the product, using the conditions described for benzene, it was quantitatively converted into methane. Similarly a purely aliphatic American benzene was converted almost completely into methane. This reaction commenced at 240° and was almost quantitative at 260°. It is suggested that the method might find application in the separation of pure naphthenes from petroleum products, the naphthenes then being examined by Zelinsky's method. S. F. B.

THE CHEMICAL NATURE OF THE NAPHTHENIC ACID I. N. Zelinsky (with A. Tschuksanowa). *Ber.*, 1924, **57** (B) 42–51.

In an attempt to elucidate the structure of the naphthenic acids, the author has applied his method of catalytic dehydrogenation to the hydrocarbons prepared from them by a series of reactions unlikely to cause any constitutional change. The conditions employed for the dehydrogenation were such that, whereas *cyclo*hexane derivatives lose hydrogen and are converted into aromatic compounds, the *cyclo*butane, *cyclo*pentane and *cyclo*heptane rings remain unaffected.

The starting material consisted of several fractions of naphthenic acids obtained from Baku petroleum. By fractionating the methyl esters, it was found possible to isolate methyl hepta- and octa-naphthene-carboxylates. That these were mixtures of isomerides was shown by the wide range over which they boiled. They were reduced by sodium and alcohol to the corresponding homologous alcohols, converted by iodine and red phosphorous into the iodides and the latter reduced by zinc in the presence of alcohol to the respective octa- and nona-naphthenes. The hydrocarbons so obtained, closely resembled *cyclo*pentane and *cyclo*hexane derivatives. They were fully saturated and unaffected by concentrated sulphuric acid or permanganate. On dehydrogenation using palladium black at 300° however, little hydrogen was observed, a fact in accordance with the view that these compounds do not possess a *cyclo*hexane ring.

S. F. B.

THE CHEMICAL NATURE OF THE NAPHTHENIC ACIDS II. N. Zelinsky and E. Pokrowskaja. *Ber.*, 1924, **57** (B) 51–58.

A continuation of the work described in the preceding abstract, the fractions containing the octa-, nona-, and deca-naphthene-carboxylic acids acids providing the starting materials. It was found that the corresponding hydrocarbons behave in a similar manner towards palladium black at 300°–310° to those obtained from the naphthenic acids previously investigated. The small amount of aromatic derivatives formed indicated the presence of *cyclo*hexane derivatives in small traces only.

S. F. B.

THE VELOCITY OF OXIDATION OF PARAFFIN WAX. Parts I.-IV. Francis Francis, and (in Part) W. F. Milland, C. H. Rutt, C. M. Watkins, R. W. Wallington and C. P. Garner. *J. C. S.*, 1924, **125**, 381–393.

Previous work has shown that paraffin wax melting at 55°–56°, obtained from Scottish Shale, consists of at least seven hydrocarbons capable of being oxidised at 100°, and that these constitute some 80 per cent. of the mixture. Besides these, there are present lower boiling hydrocarbons, as well as some which are much less volatile and which appear to be practically incapable of oxidation at 100°. The long period of treatment with the oxidising agent before oxidation commences has now been termed the latent period of oxidation. When this period has been passed, the oxidation, which is an exothermic process, proceeds quite smoothly and rapidly. From the indefinite nature of the wax it is not possible to draw very definite conclusions, but it appears that the oxidation occurs in stages. In each experiment the gas, after passing through the wax, passed through a solution of barium hydroxide, the barium carbonate formed not only indicating the commencement of the oxidation but also serving as a rough guide to the velocity of the action. Together with other products, formic acid was always found towards the end of each oxidation. At any stage an ultimate analysis indicated by

difference the extent of oxygen absorption, but it was also found that the oxidation products were always more soluble than the original wax and could be separated from it in this way. With air and a catalyst (turpentine), an intermediate stage was reached when the oxygen content was between 3–4 per cent. but oxygen reached a more clearly defined stage at 8–9 per cent. That the process is heterogenous was shown by the temperature co-efficient, which has a value of 1·6. The cause of the latent period is obscure. It is possible that a catalyst is formed which is produced more rapidly when the wax is heated in oxygen than in a vacuum, except when the heating is either prolonged or at a higher temperature. In this connection one observation is significant. Wax previously heated in a vacuum at 208° for 159 hours gave a product containing 9·9 per cent. of oxygen, when oxidised at 100° for 449 hours. After such preliminary treatment, the wax was found to be more soluble in acetone than before; when crystallised from this solvent, the resulting hydrocarbons gave on oxidation a product containing 0·7 per cent. of oxygen after 457 hours. Apparently the acetone removed a substance which catalysed the reaction; on recovery this substance was found to resemble paraffin wax closely in appearance.

With oxygen the temperature co-efficient of the latent period was 2·0, a further indication that chemical changes occur during this period.

The phenomenon of the latent period might be explained by the gradual destruction of a negative catalyst. No clue to the existence of such a substance was obtained however, nor was it found that sulphur, which has been stated to act in this manner, actually did so.

The possibility of isomeric change is also hardly feasible, as the conditions employed in the preparation of the wax commercially are far more drastic than those used during this investigation, and, if isomeric change does occur, it would be more likely to have occurred then. Evidence in favour of the formation of unsaturated substances in small amount, and previous to the onset of oxidation, which possibly act as catalysts, was obtained.

A wax, melting at 46°–47°, prepared from Braunkohle was found to be oxidised more rapidly than the paraffin wax examined. S.F.B.

The Paraffin Waxes in Petroleum.—M. A. Rakusin. *Petroleum*, 1924, 20, 951–953.

Soft paraffin wax (m.p. 51° C.) may be recovered from Grozny petroleum from the Eastern lots by adsorption by Floridine. The reaction is reversible. Hard paraffin wax (69° C.) may be obtained quantitively by centrifuging. A faultless product is obtained after once redistilling with steam. The medium paraffin wax (62° C.) has almost the same sp. g. as the petroleum, and can only be obtained by distillation. All these waxes are crystalline. Adsorption of the soft paraffin wax by Floridine also takes place from Boryslav petroleum (Burstin), and the hard paraffin wax may probably be obtained similarly by centrifuging from Boryslav oil, but not from Tscheleken oil, as this does not contain the higher homologues of the paraffin series, and only yields medium paraffin waxes, of m.p. 52° C. and 56° C. Galician and Pennsylvanian hard paraffin waxes have m.ps. of 70°–72° C. Paraffin wax used in traumatic surgery has a m.p. as high as 74°–80° C. Wax injected into rats partially disappears by adsorption or oxidation in two months, none being found in the excreta. The sp. gs. of paraffin waxes taken at their melting points are nearly alike, showing that the molecular volumes and weights are nearly proportional. Determinations of the sp. g. of paraffin waxes of various m.ps. by Redwood and by Sauerlandt have

given high results, as, m.p. 41° C., 0·8752 and m.p. 82° C., 0·943. Rakusin and Arsenjew determined the sp.g. of various waxes in the solid state by piknometer in alcohol, and got much lower results than those mentioned, namely, for soft wax, 0·8108, for medium, 0·8377 for hard, 0·8974, and for the mixed waxes, 0·8605. The sp.g. of the raw oil from which these waxes were obtained was 0·8563 at 15° C. H. M.

TESTING OF FOAM FOR USE ON FIRES. C. K. Swift. *Ind. Eng. Chem.*, 1924, **16**, 580.

Owing to the development of foam fire fighting apparatus it is a matter of importance that such a system should be as efficient as possible and the author has outlined the general principles of such systems and gives methods for testing the efficiency in the laboratory.

A layer of foam, the bubbles of which contain carbon dioxide, when spread over the surface of oil, smothers the fire by preventing access of oxygen. The materials commonly used for production of foam are solutions of bicarbonate of soda and aluminium sulphate together with a foaming agent which is generally an organic substance such as glue, glucose, licorice, or saponin extract. Sulphuric acid may also be added to these to accelerate the reaction but has the disadvantage of being corrosive. A small amount of preservative is also necessary to prevent decomposition of the organic material.

The general requirements of foam are large volume, tenacity, and fluidity, or adhesiveness when required on vertical surfaces.

Foam producing solutions deteriorate and therefore require examination at intervals. The aluminium sulphate merely loses water by evaporation and hydrometer inspection will usually indicate the required dilution. The bicarbonate solution loses CO_2 and its strength is determined by estimating the $NaHCO_3$ volumetrically using standard sodium hydrate and silver nitrate solution as an outside indicator. The expansion test or volume of foam is measured by mixing 50 c.c. of each solution in a litre cylinder noting the volume of foam produced and compared against a standard. The quality of the foam can be noted from the decrease in volume on standing or by pouring on to the surface of kerosene and noting the amount of water accumulated under the kerosene after a definite interval.

The author describes an apparatus for testing the actual fire resistence of a foam which consists of two calibrated glass vessels holding the solutions and each leading to a single outlet placed in the centre of a circular pan containing a measured quantity of gasoline. This is ignited and the two solutions admitted in definite quantity and the time noted for destruction of foam and extinction of the fire. Tests for fludity are also described. S. B.

REMEDIES FOR CRANKCASE DILUTION. *Nat. Petr. News*, 1924, **16**, 17.

Several papers were read on this subject at the summer meeting of the Society of Automotive Engineers of U.S.A. C. M. Larson asked for better methods of draining out used oil, which is at present generally a messy job and hence gets left undone. N. MacCoull determined the various temperatures at which dilution became noticeable, and found that the hotter the engine the less dilution appeared. He found that equally good results could be obtained by using one oil and varying the rate of flow through the bearing as by employing a different grade of oil for each particular purpose. R. L. Skinner described an oil rectifier, which in a twelve hour test run prevented the viscosity of a 350 crankcase oil falling below 340, whilst in a comparative run without the

rectifier the viscosity fell to 231. The device consisted essentially of a heater, warmed by the exhaust gases, through which the oil passed and was deprived of the lighter constituents by distillation. After passing through a separator to remove carbon, etc., the oil returned to the crank-case. F. G. P. R.

U.S. Government Specification for Lubricants and Liquid Fuels and Methods for Testing. U.S. Bureau of Mines Bull., 323A, 1924, 89 pages.

The specifications are for gasoline of three grades (aviation fighting and domestic, and motor), for burning oils, comprising kerosene, long-time burning, and mineral seal oil, for fuel oils, and for lubricants, the latter category comprising buffer oils, greases, paraffin wax, and switch and transformer oils. The tests for motor gasoline are colour, corrosion test, distillation range and sulphur test only. The acidity and doctor tests are added for aviation gasoline only, and it is specified to be free from water and suspended matter. Kerosene is specified for colour, flash point, sulphur, flock test, distillation, cloud point (cold test) and burning (lamp) test, and it is to be free from water, glue and suspended matter. The flash point limit is 100° F. for kerosene and 115° F. for marine kerosene, while seal oil must be not lower than 250° F. (Cleveland open cup). The fuel oils are defined as hydrocarbon oils, free from grit, etc., to be strained through filters of 16 meshes to the inch. For Navy standard fuel oil, which may be used in Diesel engines, the flash point and viscosity are specified. Sulphur must not be over 1·5 per cent., water and sediment together not over 1 per cent. For bunker fuel oils sulphur content is not specified. The flash point limit for all fuel oils is 150° F. Four classes of lubricants are specified for; for general lubrication of engines and machinery, except steam cylinders; for turbines, dynamos and high-speed steam engines; for turbines and internal combustion engines, and for internal combustion engines. Three of these are specified for in five grades: extra light, light, medium, heavy and extra heavy. The last is to be supplied in nine grades. The addition to these seventeen classes of lubricants, etc., for general and specific purposes are specified for. Part 2 of the Bulletin deals with the methods of testing lubricants and liquid fuels, and describes tests for colour, cloud and pour points, viscosity, and melting point, the distillation test, the flash point test, fire test, spot test, wick-feed and burning tests, determination water and sediment, precipitation number, the emulsion, protection and break down tests, tests for carbon residue, reaction, acidity, sulphur, the doctor test, corrosion test, saponification number, and the determination of fatty oil and of unsaturation in transformer oil. Tables of colour standards are given, and specifications for thermometers for Pensky-Martens tester. There are 21 illustrations of various testing apparatus. The specifications for various oils are also reproduced in tabulated form.

H. M.

Ural-Caspian Petroleum District.—Engineer S. Kusnitsoff. *Neph. Slants. Khoz.*, vol. 6, p. 16.

In view of the number of English companies interested in this district, the data given by Mr. Kusnitsoff will be of some value. According to the latest investigation, the length of the petroleum deposits in this district is approximately 550 miles. At present there is in exploitation only the Dossor District, which produces about 8,000,000 poods of petroleum per annum. Within twenty miles, lying North-East of Dossor, is the Makat District, where about 1,000,000 poods were produced

last year. Only the upper stratum is exploited. Further there are two districts, Kara-Chungal and Novo-Bogatinsky, where in the course of exploitation two spouters were brought in. On examining the various oils from that district, we find that in the Western part the crude oil has a lighter specific gravity than in the Eastern part, i.e., Novo-Bogatinsky crude has a specific gravity of 0·782. Dossor, the upper stratum, gives an oil 0·890 specific gravity and the lower an oil of 0·865 specific gravity. East at Makat the oil is 0·904 specific gravity, upper stratum, and 0·880 specific gravity in the lower stratum.

On analysis, Dossor crude oil of 0·865 specific gravity, gives the following results :—

Gasoline	.. ..	1·5	per cent.
Kerosene	.. ..	22·5	„ „
Solar Oil	.. ..	30·0	„ „
Spindle Oil	.. .. ..	5·0	„ „
Engine Oil	.. .. ..	14·0	„ „
Cylinder Oil	.. .. ..	2·0	„ „
Goudron	.. ..	23·0	„ „
Loss	.. ..	2·0	„ „
	Total ..	100·0	„ „

The number of districts where there are indications that Petroleum may be found is 60.

Review of the Petroleum Industry in Russia for October–December, 1923.—*Nepht. Slantz. Khoz.*, vol. 6, No. 1, p. 211.

The total quantity of crude oil produced throughout Russia, with the exception of the Fergane District, was 1,416,130 tons of which 322,000 tons were collected by the peasants in the Baku District, by means of hand-dug wells. The total number of boring operations was equal to 93,933 feet and the total quantity of crude oil distilled was 740,000 tons. The total number of workmen employed was 63,263. The quantity of fuel used in 1923 was 2,228,600 cubic sagens of wood, 540,000,000 poods of coal, 182,000,000 poods of liquid fuel and 27,000,000 poods peat.

Petroleum Possibilities of Western Oregon.—Warren du Pre Smith. *Econ. Geol.*, **19**, 455, August, 1924.

Of previous contributions, Chester Washburne's geological survey bulletin is the most important. The writer agrees with Harrison and Eaton that the Newport region offers the best possibilities of finding oil; but considers that too little work has been done to justify their negative conclusions. Other important work has remained unpublished. Since the first well was drilled in 1902, about 30 have been put down unsuccessfully. Four are now in hand, of which those near Eugene have been adversely reported on by the State University. A little shale development is going on near Ashland. A stratigraphical table is given. Pre Mesozoic formations are too metamorphosed to be oil-bearing. Of the Mesozoic, the Cretaceous offers the only hope. The Acila shales (Upper Oligocene or Lower Miocene) are the most promising formation; samples smelling of petroleum have been discovered. Sections of the Coast Range reveal few favourable structures and many igneous intrusions. Nothing comparable to the Californian diatomaceous shales has been found. No seepages are known. Near Astoria, strong gas seeps led to the drilling of a well in 1921. It was abandoned at 4000 ft. Recent studies have shown that favourable structures may exist at Nehalem.

Dry gas seeps, several small structures, and absence of igneous disturbance suggest favourable conditions at McMinnville. At St. Paul, east of McMinnville, several deep wells have been unsuccessful. The petroliferous "acila" shales occur near Newport, and, if suitable structures exist, might repay drilling. At Waldport, two ill-advised wells were abandoned. The Eugene, Cottage Grove wells will share their fate. Intermittent drilling has sunk a well to 1200 ft. at Oakland without result. At Medford a well, 2200 ft. deep, is near the igneous basement, but is unproductive. At Grizzly Peak, near Ashland, an attempt is being made to develop oil-shales. The oil is believed to have been formed in situ through the distillation of organic matter by volcanic heat. Western Oregon is regarded as a "territory of possible but not probable petroleum reserve." W. G. W.

Some Methods for Heavy Mineral Investigations.—R. D. Reed. *Econ. Geol.* **19**, 320.

The Stanford Petroleum Research Fund subsidised research into the possibility of correlating Tertiary formations in California by "heavy mineral" residues. This article gives an account of the results.

It is important to obtain a representative sample of the bed under examination. The value of well samples is limited. Some heavy minerals are so rare that they may be absent from any small fragment of rock taken at random. Thin sections, therefore, are not enough. The rare heavy minerals must be concentrated from a large bulk of rock. As they are refractory, drastic methods may be employed, but their specific gravity makes it easy to lose them, or for samples to become "salted." Time is saved by handling many samples at once, and by selecting only those methods applicable to the particular problem.

The ordinary methods of breaking down consolidated rocks, viz., soaking in water, acids, or alkali, are not always successful. Recourse is then had to crushing to the size of average detrital grains, panning, and further treatment. It is advantageous to remove cement coatings by boiling in acid, and the method does no material harm to any of the minerals. Mud is eliminated by suspension and decantation. For ordinary mineralogical research, elutriation is useless. Screening has little to be said in its favour.

Panning is one method of separating the rare from the common minerals, but separates by weight rather than by specific gravity, and requires skill. A simple separation by bromoform, by means of a large evaporating dish and filter, is useful. The light minerals should also be examined for peculiarities. The only other separation method of importance is the use of the electromagnet. It should not be employed as a matter of routine. The mineral crops may be preserved either mounted permanently on slides or in envelopes in a specially adapted card index. Both methods have their advantages, and both are described in detail.

A binocular microscope shows shape of grains well but misses many optical properties. A polarizing microscope is better. The grains can be identified by most of the usual methods, except measurement of birefringence, and more easily in non-permanent preparations. Monobromnaphthalene (ref. ind. 1·67) and Canada balsam with piperine make good temporary mounting media. A useful series of immersion fluids is given.

Particular grains can be isolated with ease under the microscope for special treatment. Becke's, or the inclined illumination method, may be used on grains for determining refractive index. Colour and

pleochroism are more marked than in thin sections. Shapes of mineral fragments depend upon their cleavage planes and are characteristic; interference figures usefully supplement this method of identification. A device is suggested by which the student may familiarize himself rapidly with the probable shape and optical properties of the fragments of particular minerals. A set of permanent preparations of common detrital minerals is useful. Ordinary identification tables are criticized, and the student is recommended to construct them for himself. Estimated quantitative analysis is untrustworthy, and should give way to actual counting of grains.

The author concludes that, because of the variety of rocks, the different purposes of investigation, and the practice of each investigator of devising his own apparatus, no rigid routine for the study of sedimentary rocks can be defined. Finally, that the pursuit of sedimentary petrography will produce results of high importance to general geology.

Useful references are given to the literature.

Geological.

On Exploitation Curves of Oil Wells in Connection with the Subterranean Conditions of Oil Deposits.—Prof. L. S. Leibenzon. *Nepht. Slantz. Khoz.*, **6**, (1), 64.

The article contains a detailed investigation of the exploitation curve of a single bore hole and of whole oil deposits as a function of the subterranean conditions of an oil deposit. In Chapter I. the author utilises the idea, specially supported by J. O. Lewis, of gas pressure in an oil bed. It is assumed that the flow of oil from the bed into the bore hole is conditioned solely by the excessive pressure of the oil gas in the bed. In order to analyse mathematically the phenomena of flow the author makes use of simple physical assumptions. The output of oil is always determined by the law of d'Arcy governing the movement of a liquid through a porous soil.

The gas dissolved in oil partially flows into the bore hole together with the oil, and partially, owing to the diminished pressure, passes into the region of the bed occupied by the free oil gas. Using the law of Henry, the pressure of the gas dissolved is assumed to be proportional to the pressure of the free gas. The process is an isothermal one.

A bore hole giving a small initial oil output declines more slowly than a bore hole having a big initial oil output (*i.e.*, output during the first year of exploitation), but the last bore hole has a greater total ultimate oil production than the first.

Natural Indications of Petroleum.—F. W. Moon. *The Cairo Scientific Journal*, **12**, (114), May, 1924.

This paper deals with oil-seepages, the accumulation of oil in suitable reservoirs, and sundry modes by which it reaches the surface naturally.

I.—Type oil-seepages.—The lighter seepage oils are first considered and variously exemplified. In Persia the "white oil" of light straw colour by transmitted light and fluorescent; sp. gr., 0·773. At Baku pale amber coloured, clear and transparent, with a pleasant ethereal odour; sp. gr., 0·78. In Sumatra (Langhat) the crude oil is port-wine in colour by transmitted and greenish by reflected light; sp. gr., 0·777. This contained 89 per cent. of light oils, and when gushing from a well under pressure of 120 lb. not a single drop reached the ground, as it was wholly vaporised. The typical Sumatra seepages are all light and volatile, and therefore hard to find. In Java, Madura, Borneo and

other islands of the Dutch East Indies the seepage oils are brownish-red, strongly fluorescent, and with a paraffin base, consequently less evanescent than Sumatra types; sp. gr., 0·857–0·965. Resembling these the rare free oil seepages of Egypt are noted. These only occur at three localities viz., at Gebel-Tanka on the eastern, and Gebel-Zeit and Jemsa on the western shores of the Gulf of Suez (Red Sea area). They are thick, reddish-brown, pleasant-smelling oils; sp. gr., 0·86–0·96. They are all situated practically on the sea shore, and no other free oil seepages are known in Egypt. This scarcity renders oil finding difficult and expensive in this country. For instance, the important Hurghada field was discovered on geological evidence only. Next, the heavier types are briefly noticed. An abstract of Mr. Beeby Thompson's description of the Pitch Lake of Trinidad is given, and a similar smaller pitch lake found at Cerro Chapapote in Mexico is mentioned. Mexican seepage oils are of a permanent nature, in contrast with the light ones of the East. They are black, sticky, tar-like substances which harden as the lighter fractions evaporate. They often form asphalt ponds of considerable depth, and may act as death-traps to unwary animals, their smooth, unruffled surface causing very perfect reflection. An unusual type of seepage is one in which the residual bitumen has an elastic-like consistency, through which rise gas bubbles sometimes 3 ft. in diameter, which burst at the surface like those in the crater of a mud volcano. Other indications are next referred to, such as the oil-smelling, oil-stained, and oil-impregnated rocks found in certain geological horizons in Sinai. Native bituminous products are alluded to as true oil indications, such as grahamite, albertite, gilsonite, wurtzilite, elaterite and ozokerite, worked on mines in various parts of the world. Some remarks are made upon oil shales composed of clay with vegetable and animal remains, and kerogen. The latter is described as a resinous substance supposed to consist of coagulated colloidal matter derived from lagoonal waters which teem with life. This view, suggested by Murray-Stewart in 1910, is amplified below. Kerogen yields crude oil upon distillation. Free sulphur, sulphur springs, sulphuretted hydrogen gas and salt water are noted as more or less doubtful indications of oil. Lastly, a warning is given of false indications, such as the vegetable and iron films often seen on the surface of stagnant pools. On cutting such films with a stick the edges remain apart, instead of joining up again, as is the case when the films are due to the presence of petroleum. Again, marsh gas proceeding from decaying matter in rivers and ponds may be distinguished by the mere sense of smell. An abnormal case is finally described of "fossil bitumen." This occurs embedded in a thick bed of blue sandstone far below the surface on the Isthmus of Tehuantepec in Mexico. The sandstone is quite unstained in proximity to the bitumen, which is clearly a foreign body embedded at the time when the sandstone was being deposited. It was derived from an oil seepage in Miocene times, and itself became a Miocene fossil.

II.—Underground accumulation of oil in reservoirs.—The author virtually adopts Murray Stewart's "colloidal absorption" theory to account for the presence of the oil in reservoirs. According to this theory, a remarkable affinity takes place between minute oily and fatty colloidal particles (suspended in the waters of lagoons and shallow seas and derived from the decaying organic remains) and finely divided particles of clay carried down by rivers and streams. The pure clay particles attach themselves to the minute oily globules and settle down to the bottom, thus forming a layer of clay containing finely divided oily matter. When sand is brought down by the rivers instead of clay, a layer of pure sand is deposited horizontally upon the layer of clay.

(No affinity exists between the sand particles and oily globules). After a series of such periodical changes we arrive at a series of alternating oily clays and pure sands. (Diagram 2.) Under ever-increasing superincumbent pressure the particles of oily matter in the clays slowly combine together, and, when the whole series is saturated with water the oily matter tends to rise, and in time migrates from the clay beds into the porous layers of sand. The clay layers become impervious to oil, which now lies between two beds of clay, and cannot escape vertically. This oil forms a very thin film in the horizontal strata, and the accumulation of oil is the direct result of earth movements, causing anticlines, synclines and domes. (Diagram 3.) As the folding proceeds an upward movement of the oil and gas would take place into the higher portions of the folds, and a descent of the water towards the lower parts. Thus the oil is accumulated to a comparatively narrow belt at the crests. (Diagrams 4 and 5.) The cracks or faults incidentally formed during the folding process may complicate matters and so affect the general distribution of oil. Diagrams 6 and 7 show how by the arrest of the oil flow towards the crest of the arch by a fault subsidiary supplies may accumulate away from this crest. An igneous dyke may have a similar effect. The retardation of the upward flow of oil at changes of gradient may similarly produce subsidiary supplies. (Diagram 8.) An ideal section is shown in Diagram 10 round a volcanic neck (Mexico), whilst domal structure may be produced by the intrusion of a laccolith. (Diagram 11.)

III.—Escape of oil from reservoirs.—Sometimes oil has escaped from a fractured stratum folded into anticlinal form by following the cracks. (Diagram 12.) Or the denudation of the anticlinal crest may expose the oil-bearing stratum along its line of outcrop. (Diagram 13.) When the seepages occur from a denuded upper oil horizon of a series, then wells sunk at the crest would tap oil contained in the lower oil-bearing beds. (Diagram 14.) This has been done at Yenangyaung in Burma. Again, cross-faults or longitudinal faults or igneous dykes may cause seepages to appear at the surface near them. (Diagrams 6, 7.) Wells should then be sunk on that side of the fault or dyke on which the oil would flow upwards towards the fault. Sometimes large seepages occur round igneous necks, as in the Ebano field near Tampico. Diagram 15 shows the effect of a volcanic neck in the piercing of strata forming "domal structure." Seepages of oil issuing from vertical beds have to be treated with caution, but the Whittier oilfield in America is cited, where a straight line of wells existed drilled into one vertical bed only. Fan-like structure occurs on the north-west coast of Borneo, with a central area of vertical bedding 400 metres across. Many seepages occur, but numerous wells have been sunk without success. Oil-seepages constitute almost our only clues to the general distribution of petroleum in the world. As these places become exhausted by drilling oil-finding will tend to become more and more dependent upon stratigraphy and structure alone. This may lead to the development of oil-shales, or even to the total replacement of petroleum by some other fuel as the driving power of the world. But—"sufficient unto the day is the evil thereof."

J. E. M. H.

Distillation and Refining.

Bauxite as a Refining Agent for Petroleum Distillation.—A. E. Dunstan, F. B. Thole and F. G. P. Remfry. *J. Soc. Chem. Ind.*, 1924, **43**, T. 180.

Certain substances have long been known to possess the property of absorbing impurities which impair the colour, odour and flavour of liquids.

Among these are bone charcoal, specially prepared vegetable charcoals, fuller's-earth, floridin, certain Californian and Japanese clays, silica and alumina. The most effective belong to the category of inorganic gels formed by the dehydration of a hydrogel, such as silicic acid or aluminium or ferric hydroxides. A cheap and convenient gel is the mineral bauxite. In its natural state it has no adsorptive qualities, but by roasting at an appropriate temperature most of the water of combination is expelled whereby the porous structure on which adsorptive qualities depend is developed. The size and structure of these pores happens to be appropriate for the adsorption of sulphur compounds and colouring matter from petroleum distillates, whilst the fact that it can be used in granular form accelerates the filtration process and obviates the use of filter presses. The Burmah Oil Company were the first to make use of this material for decolourising kerosene and paraffin wax by filtration through 1 ton filters, the used bauxite being extracted with benzine in a Merz extractor and then roasted to burn off carbonaceous matter. In 1918 the first successful experiments were made on desulphurising kerosene by bauxite alone, without the aid of any chemical treatment, where it was proved that filtration through bauxite gave a completely refined product, the best results being obtained when the bauxite was freshly ignited immediately before use and not allowed to adsorb moisture from the air. Filtration gave superior results to agitation of the oil and mineral which was most efficient for desulphurising when sieved to 30/60 mesh, but for decolourising a finer mesh was desirable. For works practice 20/90 mesh is employed. The mechanism of the refining action is one of surface adsorption and is analogous with known cases of true adsorption. Bauxite contains large numbers of ultra-microscopic pores and hence possesses enormous surface area and consequent surface energy, which is exhibited by a considerable evolution of heat when the material is moistened with oil or water. Freundlich's adsorption law is followed fairly closely both for sulphur compounds and colouring matter when filtering kerosene through bauxite, though the presence of the two adsorbable materials simultaneously produces slight deviations from exactitude. It was found that colour was adsorbed preferentially and that until about 85 per cent. of the total colour had been removed practically no adsorption of sulphur compounds took place. By means of its inherent surface energy bauxite is capable of bringing about both decomposition and polymerisation of unsaturated hydrocarbon compounds. Thus if colourless cracked spirit is filtered cold through bauxite the filtrate issues a deep yellow colour, and at 100° C the filtrate will be deep brown owing to polymerisation of unsaturated compounds to gums which are washed out by the oncoming liquid. If, however, the filtering material is maintained at a temperatue just above the final boiling point of the spirit the condensate will be colourless and free from the usual bad odour of cracked spirit owing to the fact that the gums formed are of high boiling point and are not vapourised with the unattacked portions of the spirit. These facts enable two methods for refining cracked spirit by bauxite to be employed (*a*) by filtering at 100° C. and redistilling the filtrate whereby the non-volatile gums are left in the still, and (*b*) by passing the spirit in the form of vapour through bauxite maintained at about 200–220° C. Sulphur compounds in kerosene are removable in much the same way. If kerosene is filtered at a temperature of 100–130° C. the filtrate is a bad colour and contains nearly the same quantity of sulphur as before filtration, but owing to change induced thereby in the sulphur and colour compounds is far more amenable to subsequent cold filtration than if the preliminary hot

filtration were changed to a cold one. Thus a hot and cold treatment reduced sulphur from 0·31 per cent. to 0·16 per cent., whilst two cold filtrations gave sulphur of 0·21 per cent. The present method of utilising bauxite is to filter a predetermined volume of oil through a definite weight at a fixed rate. The filter is then steamed out until no further oil can be removed economically, and the bauxite then roasted, together with a certain amount of fresh make up, in excess of air in order to remove moisture and burn out the last traces of oil and organic impurities. It is found that until colouring matter is nearly all removed bauxite has hardly any effect on sulphur compounds in oil. Thus by using a series of several filters colour compounds are progressively removed through the series, but practically no sulphur until the last filter in which is fresh bauxite. The same principle can be employed by first filtering through floridin—which is superior to bauxite as a decolouriser but inferior as a desulphuriser—and then through bauxite, whereby the latter is enabled to exert a greater desulphurising effect than if the first filter were charged with bauxite. An increase of the time elapsing between distillation and filtration appears to facilitate colour removal but to have little effect on sulphur compounds. The efficiency of raw bauxite can be determined by estimating its moisture content, since this is a measure of its pore space on which depends the adsorptive properties. Chemical composition appears to have no connection whatever with the adsorptive efficiency. The latter can also be measured by noting the quantity of heat evolved when bauxite is moistened with kerosene or the oil to be filtered. This fact enables either new bauxite after dehydration, or used bauxite after regeneration to be rapidly examined for efficiency in an apparatus named an "ergometer," which in effect is a small calorimeter holding 50 gms. of bauxite. The temperature of the latter is observed, and 20 c.c. of kerosene at the same temperature is poured on to the bauxite. A rapid rise of temperature occurs and the increase is known as the "ergometer number" of the sample of bauxite. New bauxite of good quality will have a "number" of about 16° C., whilst regenerated bauxite should give 12–14° C. rise. The test requires about ten minutes for completion and is therefore of great use for checking the progress of regeneration at any moment during roasting, since a lower figure than 10° C. indicated a fault in the process which can at once be sought for. It has been found that with all varieties of bauxities the "ergometer number" rises with the temperature of roasting the raw bauxite up to a maximum at 400° C., and then slowly falls off as the temperature increases. For example, no roasting 0·7° C. rise, at 400° C. —16·7° rise, and at 900° C.—8.8° rise. The maximum ergometer number is also in direct proportion to the moisture content of all raw bauxites, since both are a measure of the internal pore space and have been found also to be proportional to the percentage of sulphur removable by each variety examined. Decolourising efficiency also increases with increase of the ergometer number. After roasting bauxite should be cooled out of contact with moist air as the adsorption of even small amounts of moisture rapidly impairs its efficiency, a fact which can be quickly detected by the lowering of the ergometer number. Different fractions of petroleum give slight variations of ergometer readings, but not sufficient to detect the presence of additions of, for example, benzol in petrol, or impurities in the oil. Thus, if bauxite is used for refining kerosene it is immaterial what grade of kerosene is employed in ascertaining the ergometer number. Water can be employed for the same purpose since it gives numbers proportional to those obtained with kerosene but much greater, the maximum reading being observed

when the bauxite is roasted at 600–700° C. The size of the grains of bauxite has been found to be a factor in its activity, the best results being obtained with material of 30/60 mesh. This also gives a higher ergometer number than the coarser or finer grains. The shape and size of the filters and the rate of filtration appear to be of little importance provided the liquid being filtered is in contact with the bauxite from a certain minimum period of about 20 minutes. The adsorption of sulphur compounds is not directly proportional to the amount of bauxite used, the curve rising steeply at first but flattening out fairly rapidly. After use bauxite is steamed out whilst still in the filters with steam at about 150° C., 90 per cent. of the adherent kerosene being removed by the time steam issues from the bottom of the filter. 7–12 per cent. of moisture and kerosene are left in after steaming, but the bauxite is dry to the touch and can easily be tipped and conveyed to the furnaces where it is roasted at 550° C. in an oxidising atmosphere to burn off all carbon and sulphur compounds. Washing with solvents or chemicals will not remove all the adsorbed impurities or restore bauxite to its original activity, but proper roasting will effect this an indefinite number of times. After being used and recovered in this way 20 times a sample of bauxite was found to have practically the same chemical composition as the original. The amount of fines, however, passing 60 mesh had increased from 3 per cent. to 40 per cent. which slightly lowered the desulphurising power and the ergometer number, but raised the decolourising effect to a small extent.

Filtrations under increased pressure up to 240 lbs. per sq. in. gave no better desulphurising than those done at atmospheric pressure, but the use of vacuum led to encouraging results which are being further investigated. By roasting in vacuo at 2–3 mm. pressure, cooking in vacuo and admitting kerosene to the bauxite before breaking the vacuum the action was so intense that cracking appeared to have taken place. The bauxite was blackened—as if by deposition of carbon, sulphur was reduced to 0·07 per cent., compared with 0·14 per cent. at atmospheric pressures, and the filtered kerosene had a strong cracked odour. Roasting at ordinary pressures and cooling in vacuo had no effect, it being evidently necessary to roast in vacuo to free the pores from air before increased activity can be obtained. This fact renders doubtful any practical application of the method. F. G. P. R.

The Removal of Hydrogen Sulphide from Natural Gas.—Lloyd Logan and G. G. Desy. *Natural Gas*, 1924, **5**, 12–13, 36, 38, 40, 42, 44.

Hydrogen sulphide is removed from natural gas by means of sodium carbonate solution, the latter being reactivated by a current of air which in turn removes the hydrogen sulphide. In this way the solution can be used over the cycle of operations indefinitely. Results obtained in a small plant described in the paper are given. It was found possible with it to reduce the hydrogen sulphide of a natural gas from 350 to 30 grains per 100 cubic feet, and from this it is estimated that the cost, exclusive of fixed charges, to purify 15 million cubic feet a day to the same extent would be 0·54 cents per 1000 cubic feet. The purified gas gave no perceptible odour when consumed in an open gas heater without any flue. S. F. B.

The Fractionation of Complex Mixtures and Recovery of Volatile Liquids.—P. Ch. Lemale. *Chim. et Ind.*, 1924, **11**, 657–661.

By the use of the "éjecteau-air condenser" any fraction of a mixture is separated with greater accuracy and celerity than by the usual

fractionating columns. By this means any vapour may be condensed by the application of any condensing fluid. The operation is carried out under partial vacuum, and for theoretical vacuum the yield is 98 per cent. The apparatus functions on the cycle of two non-soluble liquids in distinct circuits, of which a part is common. It comprises an impulse turbine, which is rotated rapidly, and throws out the injection fluid at its periphery in a number of jets in a finely divided form. These form a partial vacuum, and meeting the vapours extract a portion of them, and are driven, together with the condensed vapours, through a narrow space between two injection plates, the clearance being such that the jets do not come into contact with the plates and thence into the condensing space. An increase of vacuum from 60 to 70 c.m. increases the efficiency 63 per cent., and at 73 c.m. mercury vacuum the efficiency is doubled. The action of the apparatus is purely kinetic. It may be applied in the sugar manufacture, in the extraction of water from alcohol, for making motor spirit, for the recovery of solvents in the waterproofing and similar trades, and for the recovery of benzol from coal tar products. Fractions within the narrowest limits may be taken from petroleum in operations in series. Graphs and tables and sketches of the apparatus are given. H. M.

TANKAGE INSTALLATION HOLDS ALL GAS FROM WELL TO PIPE LINE.—L. E. Smith. *Nat. Petr. News*, 1924, **16**, 58.

A description is given in fairly full detail of the plant employed by the Magnolia Petroleum Company for freeing the crude oil from the wells of water, gas and bottom settlings. The whole of these processes are carried out without allowing the oil to come in contact with air at any point whereby the minimum amount of loss by evaporation is ensured. The original article, which contains constructional details and photographs, should be consulted. F. G. P. R.

IMPROVEMENTS RELATING TO THE PURIFICATION OF HYDROCARBONS, PARTICULARLY LIGHTER PETROLEUM FRACTIONS.—H. D. Demoulins and F. H. Garner. E.P. 216,918, Feb. 7, 1923.

The lighter fractions of petroleum or shale oil containing objectionable sulphur compounds are submitted, in the vapour phase, to the action of an oxidising agent. The oxidising agent may be an aqueous solution of sodium hypochlorite or alkaline calcium hypochlorite. The concentration of hypochlorite is so arranged that only the impurities and not the hydrocarbons are attacked, *e.g.*, a solution of sodium hypochlorite containing 1·5 gr. of available chlorine per litre may be used for sweetening sour gasoline after sulphuric acid treatment. The treatment may be carried out concurrently with the distillation of the oil, the whole forming a continuous process. The oxidising agent may be sprayed or atomised into the dephlegmators, or separate wash chambers in which the liquid is circulated may be used. The reagent may be preheated to any required degree to promote efficiency and prevent condensation of the vapours. T. A. S.

IMPROVED PROCESS OF PURIFYING MINERAL OILS FROM SULPHUR.—The Anglo-Saxon Petroleum Co., Ltd. E.P. 214,733, Jan. 27, 1923.

Oils containing free sulphur are purified by means of sodium plumbite and a mercaptide. Unless a certain amount of mercaptide is present the free sulphur does not combine with the plumbite. The mercaptide may be added either as such or by the addition of ethyl-mercaptan to the oil. An oil in which the ratio of free sulphur to mercaptan is not correct

for the complete removal of sulphur and sulphur bodies by sodium, plumbite may be mixed with one in which the ratio is reversed, *e.g.*, Persian distillate containing little mercaptan and much free sulphur may be mixed with Egyptian distillate containing much mercaptan and little free sulphur. The mixed oils are freed from sulphur compounds by treatment with sodium plumbite in the usual manner. T. A. S.

Improvements in or Relating to the Treatment and Purification of Oils and Spirits.—V. L. Oil Processes Ltd. and O. D. Lucas. E.P. 214,871, June 21, 1923.

Spirits containing unsaturated compounds of the aliphaltic or aromatic series are purified by treating them with a mixture of hydrogen and a small amount of halogen. The gas mixture is kept in the dark so that no combination of the hydrogen and halogen takes place. To secure intimate contact the oil is heated until it is vaporized and the mixture of oil vapours and gases are passed through a filtering and polymerising medium, such as floridin, bauxite, activated charcoal or aluminium oxide. The proportion of halogen used is a mere trace. The process is particularly applicable to cracked spirits and shale distillates. The treatment is carried out in a reaction chamber maintained at 180–190° C. for a spirit having an end boiling point of 200° C. The liquid impurities collecting in the reaction chamber are periodically withdrawn. T. A. S.

Apparatus for the Treatment of Oil Refinery Gases.—F. A. Willard. U.S.P. 1,497,128 of June 10, 1924. (Appl. Dec. 13, 1920.)

Oil still gases are separated from the condensate and forced by means of exhausters through gasoline absorption plant to gas storage. Means are provided for passing gas direct to storage instead of through the absorption plant. T. A. S.

Treatment of Natural Gases.—G. Claude and E. Jordan, Assrs. to La Société l'Air Liquide. U.S.P. 1,497,546 of June 10, 1924. (Appl. Aug. 10, 1921.)

Natural gas consisting chiefly of methane and containing small quantities of less volatile hydrocarbons, nitrogen and helium is progressively cooled, under pressure, by indirect contact with the vaporized methane resulting from the treatment whereby the hydrocarbons are condensed and collected. The residual gas is further cooled by expansion and liquified, with downflow of the liquid in opposite direction to the gas, whereby a liquid consisting chiefly of methane is obtained. The residual gas consists chiefly of nitrogen and helium. T. A. S.

Apparatus for Refining Oil.—W. J. Reilly. U.S.P. 1,494,375 of May 20, 1924. (Appl. Aug. 1, 1921.)

Hydrocarbon oil is admitted at one end of a tubular chamber in which it is mixed with heated vapours. After mixing the oil and vapours pass through an enlarged space containing catalyst. Means are provided for controlling the fall in pressure along the tube. T. A. S.

Recovery of Gasoline.—N. E. Loomis, Assr. to Standard Development Co. U.S.P. 1,496,061 of June 3, 1924. (Appl. Jan. 3, 1922.)

Hydrocarbon gas is passed first through liquid absorbents and then through solid absorbents such as charcoal. The solid absorbent is then heated and the gasoline recovered from it is blended with that recovered in the liquid absorbent. T. A. S.

Motor Spirit and Oil Fuels.

The Sodium Plumbite or Doctor Test of Gasolines.—B. T. Brooks. *Ind. Eng. Chem.*, 1924, **16**, 588.

The author discusses this well-known test and shows how an apparently positive reaction may be easily confused with the reaction due to unrefined products. Although the chemistry of the doctor test is still more or less obscure, it is generally accepted as an indication of the presence of malodorous sulphur compounds, and that an oil may contain a high percentage of sulphur while being immune to the test. On the other hand, it is possible to get a positive test with oils free from sulphur, this being due to the presence of organic peroxides—the yellow-orange-brown colour changes taking place just as with the sulphurous oils. It is, however, possible to distinguish between the colour due to lead peroxide and the sulphur compounds of lead on the addition of flowers of sulphur, which in the case of sulphur compounds intensifies the colour and finally turns black. Organic peroxides are formed on keeping certain oils—*e.g.*, cracked gasoline and turpentine, each rendered immune to the doctor test, gave a positive reaction on standing a short time, the presence of peroxides being shown by the starch iodide test. S. B.

Recent Progress in the Field of Fuels and Fuel Technology.—R. T. Haslam and E. W. Thiele. *Ind. Eng. Chem.*, **16**, 7, 749.

The problems selected for investigation in the principal countries are determined by the requirements of national defence and economic necessity. In the United States, with high labour costs but excellent fuel European competition has caused attention to be directed to the production of cheap power by the erection and interlocking of large central power stations into sup-power systems and by the attainment of high boiler efficiencies through the use of powdered coal. In England the smoke problem, caused partly by the use of soft coal in open hearths and the necessity for large home supplies of fuel oil for Navy use, has caused attention to be directed to low-temperature carbonisation of coal giving smokeless semicoke and a large yield of liquid fuel. In France adequate land defence requires large quantities of motor fuel for automobile and aviation engines. The lack of petroleum and the possession of tropical colonies suggests vegetable sources for this fuel. Germany is short of oil, and the loss of high grade coal-fields causes attention to be directed to the use of low grade fuels.

The Constitution of Coal.—Stopes and Wheeler have extended their studies to the properties of durain, clarain, vitrain and fusain. Absorption of oxygen at ordinary temperatures most readily takes place with fusain, which thus begins spontaneous heating, whilst vitrain is probably the first constituent to ignite. Illingworth has discussed the action of the gamma compounds (those soluble in pyridine and chloroform) in giving coking qualities to a coal. The application of Winter's metallographic method has been made by Grounds and Seyler. The existence of durain, clarain, vitrain and fusain was established, thus confirming the view of the common origin of bituminous coal and anthracite.

High Temperatures in Power Production.—The Benson super-pressure plant at Rugby generates steam above the critical point, 3200 lb. per sq. in. and 706° F., at which point the specific volumes of steam and water are equal. No steam drum is required, as there is no boiling. No details as to economy are available. Mercury is used as a vaporising fluid at Hartford, Conn. Mercury is evaporated at 35 lb. pressure and 812° F. in a special boiler, the mercury condenser being a high-pressure

boiler as used for ordinary steam generation. Owing to the great temperature difference between the boiler and the condenser, a relatively high theoretical efficiency is possible. In practice, 50 per cent. higher efficiency than would be obtained from a 200-lb. steam turbine plant is anticipated.

Powdered Coal.—A great increase in the use of powdered coal has taken place in the United States. A gross boiler and economiser efficiency of 90 per cent. has been obtained.

Low Temperature Carbonisation.—The carbocoal process in the United States distils the coal in a stationary retort with internal agitation. The semicoke is briquetted and again distilled at high temperature with further recovery of by-products. The Green-Laucks process distils the coal in a vertical tube, through which it is forced by means of a screw. The Piron-Caracristi method distils the coal on a travelling belt passing through a bath of molten lead. The Fuel Research Board in England is experimenting with low-temperature carbonisation processes in vertical retorts. In Germany work is being done on the utilisation of low temperature tars which contain twenty times more phenol than ordinary tars. Fischer extracts the phenols with superheated water and subsequently reduces them to hydrocarbons in a heated iron tube internally coated with sulphide to prevent the iron catalysing the decomposition of the phenols.

Coal Washing.—Interest in cleaner coal is widespread. The Trent coal-oil amalgam process in the United States and the flotation process in England are directed to this end.

Lignite.—Work on the utilisation of lignites in Germany, Canada and the United States has been directed to improving this fuel by carbonising, drying and briquetting. The Hood-Odell oven for this purpose appears to be a commercial success.

Peat.—No radically new methods of industrial promise have been developed recently.

Liquid Fuels.

Anti-detonation Compounds.—Midgeley adds lead tetra-ethyl to petrol to suppress detonation. The development of high compression engines will increase the efficiency of automobile engines by possibly 30 per cent., and reduction in weight will result in a saving of perhaps 40 per cent. This would save in America 2500 million gallons of petrol per year. The use of alcohol as a motor fuel has received special attention in France. The use of higher alcohols to increase the mutual solubility of 95 per cent. alcohol with hydrocarbons has been studied. Mailhe has carried out successful laboratory experiments on cracking vegetable oils in the presence of suitable catalysts into hydrocarbons resembling natural petroleum.

Bergius Process for Production of Liquid Hydrocarbons.—Hydrogenation of oil, tar, pitch, asphalt and coal is claimed to take place at 200 atmospheres pressure and 400° C. without the aid of a catalyst.

Synthol.—Water-gas compressed to 150 atmospheres is passed at 400–450° C. over iron filings coated with potassium carbonate. Organic acids and motor fuel are obtained.

Fuel Oil.—A large increase in use of fuel oil for domestic purposes has taken place. The pressing economic necessity is a cheap, dependable oil-fuel burner for smaller houses. Mechanical atomisation is the usual method adopted in power plants. The Cannon radiation furnace burns the oil at a very high temperature in a carborundum semi-muffle furnace,

heat being transmitted by conduction and radiation to the object to be heated. Eight times the capacity per cubic foot of combustion space is obtained. T. A. S.

PROCESS FOR THE PREPARATION OF A CARBURETTING FUEL MIXTURE FOR INTERNAL-COMBUSTION ENGINES.—H. Terrisse. E.P. 216,169 of Aug. 31 1923.

Heavy fuels such as kerosene and heavy petrol, which ordinarily cause knocking in engines, are rendered usable by the addition of alcohol and acetaldehyde. The low volatility of the aldehyde is overcome by mixing the alcohol and aldehyde before addition to the fuel. A reaction takes place; a mixture of two parts of alcohol and one of aldehyde begins to boil at 46° C., 2 per cent. at 5° C., and 73 per cent. at 77° C. The aldehyde must be perfectly neutral and any acidity due to oxidation must be neutralised. Ten per cent. of the alcohol-aldehyde mixture added to a heavy petrol and 20 per cent. alcohol-aldehyde mixture makes a very suitable fuel. T. A. S.

IMPROVEMENTS IN OR RELATING TO PROCESS OF BURNING FUEL OIL AND APPARATUS THEREFOR.—R. W. Wiederwax. E.P. 216,325 of May 15, 1923.

Heavy oil is heated to just below its vaporising point under pressure. It is then flashed into vapour by coming in contact with a hot surface and also allowed to expand. At this point it is mixed with superheated steam or highly heated air. The preheating of the oil and air or steam is carried out in a burner casing built into the furnace wall. The oil is flashed into vapour on leaving a jet in the burner pipe. A subsidiary burner is provided to heat the burner case. T. A. S.

FUEL COMPOSITION.—D. B. Keyes, Assr. to U.S. Industrial Alcohol Co. U.S.P. 1,496,810 of June 10, 1912. (Appl. Dec. 29, 1921.)

The fuel consists of a low member of the monohydric alcohol series, a butylene and a light petroleum distillate. T. A. S.

FUEL COMPOSITION FOR INTERNAL-COMBUSTION ENGINES.—G. H. Taber and H. Essex. U.S.P. 1,495,501 of May 27, 1924. (Appl. November 11, 1918.

The fuel consists of gasoline and solvent naphtha boiling at 135–190° C. T. A. S.

MOTOR FUEL.—W. G. Dunning. U.S.P. 1,495,005 of May 20, 1924. (Appl. Feb. 12, 1923.)

The fuel consists of gasoline with up to 10 per cent. of creosol. T. A. S.

LIQUID FUEL.—F. W. Ferrer. U.S.P. 1,496,260 of June 3, 1924. (Appl. July 12, 1921.)

The fuel consists of acetone 125 parts, camphor 5 parts, naphthalene 5 parts, methyl alcohol 180 parts, ether 135 parts, amyl alcohol 40 parts by weight. T. A. S.

MOTOR FUEL.—R. H. McKee. U.S.P. 1,494,613 of May 20, 1924. (Appl. Jan. 16, 1922.)

The fuel consists of the gasoline-like fraction of shale oil and contains nitrogen bases. T. A. S.

Cracking.

The Volatile Yellow Colouring Matter in Cracked Gasolines.—B. T. Brooks and H. O. Parker. *Ind. Eng. Chem.*, 1924, **16**, 587.

The colour of cracked spirit may be due to contamination of heavy residue carried over during distillation, and also to the oxidation products formed on keeping, but apart from these causes some cracked gasolines freshly distilled over an efficient column show a yellow colour which varies in intensity with the unsaturated content. A similar colour characterises the crude spirit obtained from carburetted water gas tar and Pintsch gas condensate, and the reactions of such spirits with sulphuric acid suggest the presence of conjugated diolefins. Whereas the simple olefines give no tars and very little rise in temperature with sulphuric acid, these highly cracked yellow gasolines give black tarry products and considerable heat of reaction and behave similarly to the known diolefines. Pure paraffin wax and medicinal paraffin carefully purified over sodium, on decomposing under regulated conditions, both give the yellow spirit, showing the formation cannot be due to impurities containing oxygen or sulphur. The similarity to the conjugated diolefines is further shown by the readiness in which these spirits polymerise in the presence of sodium or hot fuller's earth. The yellow colour turns to dark brown, which on redistillation remains in the residue, the distillate being colourless. Heat alone is sufficient to induce polymerisation, because this yellow spirit on heating to 315° to 360° C. in an autoclave (*i.e.*, below cracking temperature) gave a colourless distillate and no energetic reaction with sulphuric acid. This colouring matter has not yet been isolated, and the authors do not think it can be recovered from the polymerising agent—*e.g.*, fuller's earth, but suggest fractional separation by means of solvents and the use of mercuric acetate. S. B.

On the Pyrogenetic Dissociation of Acyclic Hydrocarbons.—H. Gault et alia. *Comptes Rendues*, **178**, 1562.

The authors suggest that the study of the thermal decomposition of the lighter hydrocarbons has a very limited application to industrial cracking processes. Consequently, they have confined their work to compounds containing at least 16 carbon atoms, paying special attention to the exact physical conditions involved in the reactions (*e.g.*, temperature, pressure, rate of heating, etc.), and to such chemical items as catalysts, composition of the products, etc. So far they have investigated the influence of (*a*) temperature, (*b*) amount of liquid introduced, (*c*) duration of heating. The authors give a diagram of the apparatus used. The hydrocarbon in the liquid form is introduced into an inclined electrically heated retort and the products pass through an ice-cold condenser to a gas-holder for analysis. The first researches were carried out on hexadecene and hexadecane, but no results are published. The hexadecene was prepared by a modified Krafft's method by distilling cetyl palmitate at a pressure of 330–350 mm., redistillation of the product, extraction with alcohol, neutralisation by potash and washing in water. Hexadecane was obtained by the hydrogenation of the hexadecene by Brochet's method for octane, using nickel catalyst.

A. W. G.

Improvements in or relating to the Treatment of Hydrocarbon Oil Vapours and Apparatus therefor.—F. Lamplough. E.P. 216,922 of March 1, 1923.

During the cracking of oil or shale distillation the sudden cooling of the gases results in the escape of gases rich in hydrogen, with the result

that unsaturated bodies remain behind. The cooling of the vapours obtained must be gradually carried out. In the patent this is brought about by causing the gases to impinge upon or pass through a moving sheet of condensed vapour. In the case of shale oil the vapour is cooled gradually to a temperature of 150–200° C., and thereafter rapidly cooled and the resultant gases scrubbed. A Scotch shale distilled by the ordinary methods yields 25 gallons of oil to the ton. By the combined method of retorting and vapour treatment described the yield has been brought up to 40–50 gallons per ton, and whereas the oil obtained by the Scotch method contains 30 per cent. of unsaturated compounds, by the present system only 5–10 per cent. of unsaturated bodies is obtained.
T. A. S.

PROCESS OF TREATING HYDROCARBONS.—J. H. Riddick. U.S.P. 1,496,742 of June 3, 1924. (Appl. April 19, 1919.)

Hydrocarbons are cracked by submitting them to the action of an electric arc submerged in the hydrocarbon. The electrodes are mechanically operated to free them from the deposits of carbon formed.
T. A. S.

ELECTRICALLY HEATED OIL CRACKING APPARATUS.—C. M. Page. Assr. to G. Fabyan. U.S.P. 1,494,125 of May 13, 1924. (Appl. March 22, 1922.)

An oil still with a main heating device is fitted with supplementary electrical heaters supported in the vapour space of the still. The heating device consists of two concentric cylinders, the heating unit being within the inner cylinder, the heating effect being located near the middle of the passage between the two cylinders.
T. A. S.

PROCESS OF TREATING PETROLEUM AND PETROLEUM DERIVATIVES.—H. B. Setyler, Assr. to National Refining Co. U.S.P. 1,494,191 of May 13, 1922. (Appl. Oct. 22, 1915.)

Oil is passed into a sealed vessel fitted with means of agitation whereby carbon is abraded from the walls and kept in suspension. The vessel is heated until cracking temperatures and pressures are established.
T. A. S.

LUBRICATING OILS AND WAXES.

DETERMINATION OF ANHYDROUS SOAP IN A LUBRICATING GREASE.—B. Joachim. *Ind. Eng. Chem.*, 1924, **16**, 725.

The following method is claimed to be quicker and more accurate than the A.S.T.M. method for the analysis of greases.

Free Fatty Acid.—10 gms. of the sample are refluxed with a neutral mixture of 10 c.c. 95 per cent. alcohol and 90 c.c. benzene until dissolved. The solution is filtered through a Gooch crucible and the insoluble matter washed with hot benzene, dried and weighed. The filtrate after dilution with 25 c.c. 50 per cent. alcohol is titrated with 0·1 N NaOH and phenolphthalein.

Fatty Acid from Soap.—5–10 gms. are mixed with 3 gms. of powdered potassium bisulphate and heated on a steam bath with constant stirring for 20 mins. The mixture is then diluted with benzene and filtered through cotton wool, and after adding 60 c.c. 95 per cent. alcohol is titrated as before with 0·1 N NaOH and phenolphthalein.

The difference between the two titrations gives fatty acid value.

Soap.—The solution after the above titration is diluted with water to 50 per cent. alcoholic and allowed to separate. The lower layer is

extracted with 25 c.c. naphtha and the soap solution evaporated nearly to dryness and the fatty acids liberated with dil. H_2SO_4 (1 : 10). The fatty acids are then dissolved in ether, washed free from acid and alcohol added to make 50 per cent. alcoholic and titrated with 0·1 N NaOH. This solution can be evaporated to dryness in vacuo, dried at 105° C. and weighed as soda soap.

From these results the equivalent of any soap in terms of 0·1 N NaOH is calculated.

The nature of the soap is determined by ashing the alcohol benzene solution of the grease after filtration and estimating the metallic radical in the usual manner. S. B.

Specific Heats of Lubricating Oils.—E. H. Leslie and J. C. Geniesse. *Ind. Eng. Chem.*, 1924, **16**, 582.

Having regard to the importance of specific heat in the design of automatic lubricating systems and heat exchangers the authors have investigated this constant for various types of lubricating oils over a range of temperature from 100° F. to 290° F.

The calorimeter employed consisted of a vacuum vessel suitably lagged and contained in a Parr calorimeter pail and the heating element of chromel wire connected to storage cells. Stirring gear was also fitted to run at constant speed of 1100 r.p.m.

Readings of time, voltage, amperage and temperature were taken at definite intervals over a rise of each 5° C., and after correcting for heat loss to the system, the heat energy supplied to a weighed quantity of oil was calculated.

Although the specific heat differed with each particular oil they all showed an increase of 35 to 40 per cent. over the range of temperature 100°–290° F.

The authors are of the opinion that this is due to molecular structure, and suggest that there may be relationship of this constant with viscosity and other properties of an oil. S. B.

Determination of the Sludge Value.—F. Schwarz and J. Marcusson. *Petroleum*, 1924, **20**, 776–777.

With regard to the authors' method of determination of sludge value, Krammer remarks that the shaking up of the alkaline tar-soap solution with petroleum spirit is not sufficient to remove the neutral substances, and recommends further treatment with benzol, by which much lower sludge values are obtained. Kasimir finds that the benzol-extract is of an asphaltic character, and should remain in the sludge. The latter assumption is correct, but the extract does not consist of neutral asphaltic substances, but of the alkali salt of asphaltogenic acids, which are somewhat soluble in benzol. As the amount of petroleum-spirit extract varies with the sludging value, Kasimir draws the conclusion that it consists of asphalt, and not adherent oil. The authors have proved this to be an error. The extract has a higher refractive index (1·568 against 1·504) than the oil, but is not of an asphaltic nature. All high-boiling mineral oils contain such strongly refractive constituents, which are more easily soluble. v.d. Heyden and Typke also consider that the substance extracted by petroleum spirit should remain in the sludge. These investigators precipitated the sludge with mineral acid, thereby causing a change in the solubility of the substance. The authors consider the extraction with petroleum spirit to remove oil, which does not belong to the sludge, and recommend twice repeated treatment with petroleum spirit. H. M.

THE ACTION OF VARIOUS SOAPS ON TRANSFORMER OILS.—v.d. Weyden and Typke. *Petroleum*, 1924, **20**, 857–858.

After investigations on the action of metals and metallic salts on transformer oils (*cf. Journ.* 43, p. 173A) the direct action of metallic soaps was tested. A mixture of American and German oils was used. 150 g. oil and 0·5 g. soap were heated to 120° C. for 70 hrs. in a 300 c.c. flask with perforated cork. The product of the acid value and sludge value was taken as an indication of the degree of action of the respective soaps. The constants were taken from the oil after the sludge had settled off. As the soaps are more or less soluble in oil, and the dissolved soap enters into the computation of the sludge value, a slight disturbance of the result ensued, and was allowed for. The remainder of the sludge value is attributed to the unfavourable influence of the soaps as regards sludging. Copper and iron soaps had a particularly unfavourable influence (acid sludge value = 20,690 and 10,250), and magnesium and aluminium oleates gave values of 6230 and 5470 respectively, though magnesium oxide and carbonate and aluminium oxide have a favourable influence. Sodium and potassium soaps have little action, and the sludge from a lead-lined transformer also gave a low value (540), the lead soap being only slightly soluble in oil. H. M.

THE DETERMINATION OF LUBRICANT FRICTION.—R. Vieweg. *Petroleum*, 1924, **30**, 899–903.

The results obtained on machines for testing the friction of oils are usually of little value for the deduction of generalisations or for practical purposes, as such apparatus only serve as a form of viscometer. In experiments on the friction of lubricants it is necessary to eliminate extraneous factors, as the heating by current in electric motors, air friction, etc. To eliminate air friction it is necessary to base the estimation on the maximum increase of temperature of the bearing over that of the surrounding air. This is a direct function of the friction of the bearing apart from air friction, and varies according to the viscosity of the oils experimented on, while the air friction remains constant. If a machine be allowed to run at a certain number of revolutions till the excess temperature of the bearing attains a constant maximum, and the efficiency, and hence the loss by friction, be observed, the results of a series of experiments give a number of points which, when plotted out in a temperature-loss diagram, give a straight-line graph. By extrapolation the point of no bearing friction may be obtained, and from this the air friction may be deduced. The point at which the temperature is taken should be as close as possible to the point of highest temperature of the bearing. If several points are taken, the different resultant graphs should cut the ordinate of loss by friction in the same point. Experiments were made with two three-phase motors—one with ball and roller bearings, and the other with solid bearings and ring lubrication. Mercury thermometers were used to indicate the temperature, which was taken as near as possible to the bearing surface. Graphs of the results are given, as also graphs showing the relation between the loss by friction and the number of revolutions. Whether the friction is fluid or semi-fluid has no influence on the results. H. M.

THE ADSORPTION OF RESINOUS SUBSTANCES AND PARAFFIN WAXES.—L. Gurwitsch and N. Tschernojukow. *Petroleum*, 1924, **20**, 903–904.

Resinous substances are adsorbed considerably more energetically than paraffin waxes, and the adsorption of the latter increases with the

molecular weight. The opposite has been affirmed by Rakusin and by Burstin. Experiments were made on a petroleum oil from Grozny of sp. g. 0·8642 at 15° C. with 9 per cent. of paraffin wax content (by Holde) and 23 per cent. of resinous substances (determined with sulphuric acid). The oil was agitated for an hour with 10 per cent. of Florida earth at room temperature, and filtered at 50° C. The adsorption of paraffin wax was so small that it was not detected by tests made on the treated and untreated oil. The adsorbed oil was then extracted from the Florida earth with ether, and the paraffin wax separated, when its m.p. was found to be 56° C. against 54° C. for the paraffin from the untreated oil. The small quantity adsorbed was, therefore, of high molecular weight. The earth being rextracted with benzene, considerable quantities of resinous substance and soft asphalt were found. Similar results were obtained when the oil was treated with infusorial earth. Experiments made on narrow fractions obtained from ozokerite confirmed the greater adsorption of the paraffin waxes of high molecular weight. H. M.

THE HEATING OF TRANSFORMER OILS WITH METALS WITH EXCLUSION OF AIR.—Dr. v.d. Heyden and Dr. Typke. *Petroleum*, 1924, **20**, 1128–1129.

In continuation of previous researches (*cf. J.* **43**, p. 173A) various metals were heated with transformer oils in the absence of air, and the oil subsequently tested. A 200 ccm. Erlenmeyer flask was filled to the brim with oil and closed with a cork carrying a funnel containing hollow glass balls, allowing very little access of air. The metal plates used were 25 mm. by 30 mm. The flask was heated in an oil bath to 120° C. for 70 hours. The oils were tested for colour, precipitate, viscosity Engler at 20° C., ash content, acid value and sludge value. The oil before heating had a yellow colour, viscosity 4·2, ash content nil, acid value 0·02, and sludge value 0·10. After heating it had a yellowish brown colour, no precipitate, no ash or very slight trace (under 0·003%), acid value 0·07, and sludge value 0·08. The viscosity varied only from 4·30 to 4·72 Engler. The metals employed were copper, polished, weathered and oxidised; tinfoil, lead, black iron, tinned iron, zinc and aluminium. H. M.

A NEW SLUDGING TEST FOR TRANSFORMER OILS.—W. H. Nuttall. *World Power*, 1924, **2**, 92–96.

The Iodine absorption value is a rational test of the sludging tendency of a transformer oil, as the presence of unsaturated hydrocarbons, which are easily oxidised and polymerised, is responsible for the formation of sludge. Any test measuring the proportion of unsaturated hydrocarbons in an oil will serve as a test of its sludging properties. A physical test is proposed based on the fact that, while a saturated hydrocarbon oil has little affinity for water, unsaturated oils possess an affinity for water or aqueous solutions. On applying a drop of oil to the surface of water the degree of spreading which takes place indicates the tendency of the oil to sludge. A drop retains its globular form when the surface tension of the oil is less than the surface tension of the water plus the interfacial tension of oil and water. When, on the contrary, it is greater, the oil spreads. The surface tension of transformer oil is constant, the surface towards air being composed of terminal methyl groups, and so is that of water, but the interfacial tension of the oil and water varies inversely as the degree of unsaturation of the oil. Determinations were made of the interfacial tension of the oil and a 40% solution of sulphuric acid by allowing the latter to flow into the oil from a pipette of standard aperture, and counting the drops produced. A 10 ccm. pipette had the

tip replaced by a capillary tube with a tip of 0·385 cm. external diam. ground to an even surface at an angle of 90° to the axis. By an arrangement of dropping funnels filled with mercury a steady flow of about four drops per minute was obtained. The sides of the capillary were wiped free from acid and it was immersed in a cylinder containing transformer oil. From the number of drops from 100 ccm. of acid the volume of the drop is calculated. A correction is necessary to obtain the volume of the ideal drop, as only a fraction of the drop formed at the tip of the pipette falls from it, and from the volume of the ideal drop the interfacial tension is calculated. A graph is given, showing that the curve of interfacial tension corresponds somewhat closely to that of sludge value.

H. M.

Determination of Sludge Value.—Bauerschäfer. *Mitt. Materialprüf.*, 1923, **41**, 94.

In determining the sludge value, similar values were generally obtained whether oxygen was introduced or not, but some oils gave higher values with oxygen. The oxygen may be dispensed with to simplify the operation. A source of error in the usual estimation arises from the fact that during 70 hours heating the oil has an evaporation loss of some 10%. This should be taken into account when calculating the sludge value.

H. M.

The Heating of Transformer Oils with Various Salts.—H. von der Heyden and K. Typke. *Petroleum*, 1924, **20**, 953–955.

In continuation of previous work (cf. *J.*, 173A) the behaviour of transformer oils heated in the presence of various salts and metals was investigated. 150 g. of oil was heated for 70 hrs. at 120° C. in a 300 ccm. flask, the cork being bored to admit air. The two oils used had yellow colour, no ash content, viscosity Engler at 20° C. (1) 4·6, (2) 4·2; acid value, (1) 0·08, (2) 0·02; and tar value by Kissling's method (1) 0·11, (2) 0·10. Metal plates 25 × 30 mm. were used and 0·5 g. of the salt. Particulars of 43 tests with different metals, different salts, and combinations of metals and salts are given, the acid value multiplied by the sludge value being taken as an indication of the degree of action on the oil. As metals, bright copper, oxidised copper, and bright copper and iron together were taken. Magnesium oxide and carbonate, aluminium oxide, zinc oxide and water glass gave the lowest degree of action, alone and in conjunction with metals. Potassium hydrate, sodium hydrate and sodium carbonate reduce the action in the presence of copper. Potassium and ammonium carbonates reduce the action in the presence of oxidised copper, but increase in it the presence of bright copper. Litharge and red lead greatly increased the action. Talc increased the action greatly in the presence of bright copper. Substances of a weak basic or neutral reaction diminished the action the most. H. M.

Coal, Shale, Pitch and Asphalt.

The Relation between the Hydrogen Content of certain Charcoals and some other Properties.—H. H. Lowry. *J. Am. C.S.*, 1924, **46**, 824.

Non-activated charcoal, prepared from twenty-three different samples of anthracite coal, was examined and measurements made of the chemical composition, apparent densities in air and various liquids, adsorptive capacity and porosity as determined by adsorption of water vapour. After heating at 900°–1200° hydrogen to the extent of 0·21–0·53 per cent. always remained, but this was found to decrease

with increase of temperature, graphitisation of the coal apparently being necessary for the formation of a hydrogen-free charcoal. The measurements of porosity, density and adsorptive capacity showed that these properties are functions of the hydrogen content, and these facts are taken as evidence in favour of the theory that amorphous carbons are in reality hydrocarbons of low hydrogen content. Any treatment, therefore, which tends to increase the unsaturation in these residues increases their adsorptive capacity. S. F. B.

A Study of the Rate of Oxidation of Certain Charcoals.—H. H. Lowry and S. O. Morgan. *J. Am. C.S.*, 1924, **46**, 846.

The rate of oxidation of non-activated charcoals, prepared from anthracite coals (see previous abstract) has been found to be roughly proportional to the hydrogen content and the surface area as measured from the adsorption of water vapour. The latter relationship was shown to be in accordance with the view that the oxidation of charcoal is analogous to the rate of solution phenomena. The rate of oxidation at 450° was also found to be greater in a charcoal preheated in hydrogen at 1030° than at 1070°. These facts are explained by an increase in the resistance of the carbon atoms and by a decrease in the surface area due either to shrinkage or to the decomposition of methane formed by the hydrogen, with consequent blocking of the capillaries of the charcoal. S. F. B.

Constitution of Melene.—J. Marcusson and F. Bottger. *Ber.*, 1924, **157**, (B), 633–635.

The authors have isolated melene, previously found in coal, vacuum-tar and Galician paraffin, from an Indian paraffin melting at 59–60°. It can readily be obtained from this source by crystallisation, at first from benzene and finally from light petroleum. The pure substance melts at 62–63°, has sp. gr. at 25° 0·9037, at 65° 0·7913 and at 90° 1·4228. Analytical data point to the composition $C_{30}H_{62}$ instead of $C_{30}H_{60}$, as previously accepted. Unlike the naphthenes with strong nitric, and it gives a mixture of aliphatic acids instead of nitro-derivatives; moreover, fatty acids are formed when melene is oxidised by air in the presence of manganese dioxide. It is also slowly assimilated by bacterium aliphaticum, which is unable to attack naphthenes. This evidence points to a paraffin structure. S. F. B.

Improvements in Bituminous and like Compositions.—T. H. Butler and F. J. W. Popham. E.P. 216,911 of Feb. 5, 1923.

A mineral filler such as limestone is dispersed in a bituminous material by means of a colloid mill. The mixture is made substantially without water. A suitable mixture is tar 8 lb., limestone 4 lb., water 250 cc., 10 per cent. NaOH 50 gr. The incorporation is carried out in a machine having disintegrating elements moving with a relative velocity of at least 2000 metres per minute. Suitable dispersators or protective colloids are used, and trial mixings are made to determine the quantities. Bituminous oils consisting of all paraffin or all aromatic products are unsatisfactory, the best results being obtained with mixtures. A mixture consisting of petroleum bitumen (E grade Mexphalt) 6 parts, coal tar creosote 6 parts, and dried clay 2–6 parts is stable after treatment in a colloid mill for one minute. If the quantity of petroleum bitumen is increased mutual precipitation of the clay and bitumen takes place. The products are used in road making and treatment. T. A. S.

EXTRACTING VOLATILE OILS FROM COAL GAS, NATURAL GASES OR OTHER SIMILAR GASES.—K. Ikeda, H. Isobe and T. Okazawa. E.P. 202,795 of June 27, 1922.

Gases which contain condensible constituents such as benzol, pentane, hexane, naphthalenes, etc., when passed through acidic clay, such as fuller's earth, Florida earth or the like, are stripped of their valuable condensible portions and can then be better employed for illuminating purposes. The clay is kneaded with an equal weight of water, pressed through a sieve, and the threads thus formed broken into small pieces and dried at 150–600° C. The clay is then packed into a jacketed cylinder connected to a condenser supplied with a liquid receiver and gas take-off. Gas to be stripped is passed through the clay, condenser and gas take-off until the clay is saturated. Steam is then admitted to the jacket and the adsorbed liquids distilled off from the clay, a gentle steam of gas being at the same time passed through the clay to assist in driving off the products of adsorption. F. G. P. R.

OIL SHALE RETORT.—J. B. Jenson. U.S.P. 1,493,880 of May 13, 1924. (Appl. July 18, 1921.)

The retort consists of a vertical cast-iron shell having outwardly projecting flanges and surrounded by a heat chamber. A vertical column built up of spaced inverted frusto-conical sections is mounted concentrically with the shell. A similar column with the cone sections facing downward is mounted centrally in the retort and serves as a vapour off-take. The shale falls between the two built-up columns. A conveyer carries shale to the top of the retort. T. A. S.

TO ABOLISH THE BURNING OF RAW COAL.—David Brownlie. *Colliery Engineer*, **1**, 287–292, August, 1924.

The industrial supremacy of Great Britain is based essentially on coal, and the fact that our coal supplies will not last for ever makes it evident that coal is too valuable to be burnt as mere fuel. A brief resume is given of the progress towards the abolition of burning raw coal and particularly of low-temperature carbonisation. Millions are spent annually in importing petroleum and its products and nitrate, and in searching for petroleum thousands of miles away, while all our oil and fixed nitrogen requirements already exist in British coal and can be produced in our own country if the colliery industry will develop the scientific use of coal.

Great Britain produces about 250,000,000 tons of coal annually, of which 75 per cent. is consumed at home. Of this home consumption, only 20·2 per cent. is carbonised by high-temperature methods, and practically nil by low-temperature methods, about 149,500,000 being burnt as raw coal.

The future undoubtedly rests with low-temperature carbonisation or allied methods, of which over 40 different processes are being investigated to-day. Taking the combined output of half-a-dozen or more distinct processes, the average process may give from one ton of coal, with 25–30 per cent. volatile matter, 14 cwt. (70 per cent.) residual low-temperature fuel, 18–19 gallons liquid products, including 2–4 gallons motor spirit and at least 10 gallons Diesel oil, 15–25 lbs. sulphate of ammonia, and 4–5000 cu. ft. of gas of 750 B.Th.U. per cu. ft., together with sufficient gas to heat the retorts. Therefore, if the amount of coal annually used in its raw state as fuel were subjected to low-temperature carbonisation, there would be obtained nearly 75,000,000 barrels

Process.	Retorting time. Hrs.	Retorting temp. ° F.	Liquid Products. Low-temperature tar. Gals.	Motor spirit. Gals.	Sulphate of ammonia. lb.	Gas, and Cal. value in B.Th.U. Cu. ft.	Low-temperature Fuel. Cwt.	Volatile content. Per cent.
Coalite	8	1000	20	3	15	4500–5000	14	9–10
Tozer	4–4½	900–1000	19	3·9	—	4500 (600)	15	—
Nielsen	2½	1250	20	—	15–20	4900 (735)	14·75	11·5
Fusion	2–3	840–390	37·5	—	—	1830 (750–900)	14·8	7·10
Fellner-Ziegler	—	1110	6·5%*	1·5%	—	—	77%	10
Freeman	1h. 42m.	750–800	25	—	—	1200 (750)	15·15–5	—
McLaurin	20	1250	15·5	—	20	27,720 (250)	11	4
Power Gas Corpn.	3–4	570–750	21	—	90	118,000 (185)	—	—
Pure Coal Briq.	—	1650	15–20	3–5	38–40	10,000 (500)	14	2
Carbocoal†	2–3	1400	21	—	—	5500 (650–700)	—	8–10
	8	1800	5	—	20	4500 (300–400)	14·5	3–4
Lamplough	—	800–900	18–20	4	15–25	2000	15	—

* In addition to the tar and motor spirit, 9·75 per cent. of pitch was obtained.

† In this process the coal is pulverised and first carbonised for 2–3 hours, the residual fuel briquetted with pitch as binder, and passed through the secondary retorts, the resulting 14·5 cwt. of smokeless fuel briquettes containing 1–1·5 cwt. of pitch.

(40 gallons) of oil, and over 500,000,000 gallons of motor spirit, 1,350,000 tons of sulphate of ammonia, that is fixed nitrogen, together with a considerable amount of surplus gas. Finally, the residue of 104,650,000 tons of smokeless low-temperature fuel containing, say, 10 per cent. volatile matter, would replace raw coal in practically every operation.

With raw coal as fuel, the average working efficiency of British boiler plants, etc., as regards heat conversion is only 58 per cent., owing chiefly to the escape of volatile matter in the form of smoke, but with low-temperature fuel this percentage would be increased. With household fires, the efficiency of the open grate with raw coal is only 20 per cent., but with low-temperature fuel it would be 35 per cent.

The practical difficulties of low-temperature carbonisation are dealt with and a brief description of the following processes given: Coalite, Tozer, Nielsen, Fusion, Fellner-Ziegler, Summers, Richards-Pringle, Pritchard, Freeman, McLaurin, Power Gas Corporation, Pure Coal Briquette, Carbocoal, Pintsch, Pluto, Lamplough, Marshall-Easton, and the Caracristi. The results obtained per ton of average coal by some of these processes are stated on page 261A.

In conclusion the author states that the work already undertaken is enormous and that the erection of half-a-dozen large plants operating on the most promising systems would solve the remaining problems in several years. From a national point of view the cost would be negligible and less than the cost of one battleship. G. S.

Current Bibliography

Compiled by W. J. Wilson, F.I.C., A.C.G.I.

1. Geological.

Coal as an Oil Indicator.—*Petr. Times* **12**, 94.

Petroleum Mother-rocks and Mother Substances.—E. de Hautpick. *Mining J. Petr. Times* **12**, 110.

Relation between Diatomaceous Formations and Petroleum Beds of Upper California.—C. F. Landero. *Bol. petroleo* **16**, 158.

Geologists believe Wellington Dome Area will be Enlarged.—*Nat. Petr. News* **16**, (23), 40.

The Eruption of a Mud Volcano on the Island of Loss in the Caspian Sea, and its Connection with the Structure of the Pliocene Folds of the Caucasus.—S. Zuber. *Oil News* **16**, 207. *Petr. World* **21**, 376.

Artesian Control of Oil and Gas Accumulation in Lake Basin Dome.—*Oil and Gas J.* **23**, (6-A), 88.

East Dip of the Cromwell Structure.—C. D. Lockwood, *Oil and Gas J.* **23**, (8-A), 23.

Micro-palæontology Ultra Scientific but of Commercial Value.—P. Wagner. *Nat. Petr. News* **16**, (29), 85.

Bradford Sand Cores Expected to Cast Light on Flooding Problems.—L. E. Smith. *Nat. Petr. News* **16**, (30), 39.

Petroleum Geology, Past and Present.—R. Arnold. *Oil Weekly* **33**, (2), 27; (3), 37.

The Fort Norman Oilfields of Canada.—G. S. Hume. *Rept. Can. Geol. Surv. Petr. World* **21**, 353.

Relation of Water and Oil.—*Petr. Age* **14**, (3), 64.

Geology of Sayer, Beckham Co., Okla.—*Bull. Amer. Assoc. Petr. Geol.* (May-June). *Petr. Age* **14**, (3), 65.

Underground Water as a Guide to Petroleum.—E. de Hautpick. *Mining J. Petr. Times* **12**, 368.

Determining Fluid Content of Formations.—V. H. Wilhelm. *Oil Weekly* **34**, (7), 41.

The Origin of the Cap Rock of Salt Domes.—J. E. Hackford. *Oil Engineering and Finance* **5**, 512.

SIMILARITY OF STRUCTURES IN MEXIA FAULT ZONE.—F. H. Lahee. *Oil Weekly* **34**, (9), 24.

SUBSURFACE CONDITIONS IN THE HEAVY OIL-PRODUCING AREA OF SMACKOVER, ARKANSAS.—H. W. Bell. *Bull. Amer. Assoc. Petr. Geol.* **7**, 672.

THE ROBBERSON FIELD, GARVIN COUNTY, OKLAHOMA.—A. R. Denison. *Bull. Amer. Assoc. Petr. Geol.* **7**, 625.

COLORADO GAS WELL INDICATES BIG NEW FIELD.—R. G. Dill. *Oil Trade J.* **14**, (12), 30.

THE POSSIBILITIES OF OIL AND GAS IN SOUTH-WEST VIRGINIA AS INFERRED FROM ISOCARBS.—*Bull. Amer. Assoc. Petr. Geol.* **7**, 421.

THE ORIGIN OF LIGHT OILS IN THE ROCKY MOUNTAIN REGION.—W. H. Geis. *Bull. Amer. Assoc. Petr. Geol.* **7**, 488.

THE RELATION OF THE REYNOSA ESCARPMENT TO THE OIL AND GAS FIELDS OF WEBB AND ZAPATA COUNTIES, TEXAS.—R. A. Jones. *Bull. Amer. Assoc. Petr. Geol.* **7**, 532.

OIL AND GAS PROSPECTS IN SOUTHERN PERKINS COUNTY.—G. F. Moulton. *South Dakota Geol. and Natural History Surv. Circ.* **14**.

TWO DECADES OF PETROLEUM GEOLOGY.—R Arnold. *Bull. Amer. Assoc. Petr. Geol.* **7**, 603.

OIL AND GAS DEVELOPMENT OF THE LARAMIE AND MEDICINE BOW DISTRICTS.—A. B. Bartlett. *State Geol. Dept., Cheyenne, Wyoming, Press Bull.* 15.

THE OIL HORIZONS OF ENGLAND.—C. E. N. Bromehead. *Geol. Mag.* **60**, 297.

NOTES ON THE SIMPSON FORMATION, OKLAHOMA.—F. C. Edson. *Bull. Amer. Assoc. Petr. Geol.* **7**, 558.

SOME IDEAS REGARDING OIL ACCUMULATION IN THE ROCKY MOUNTAIN REGION.—T. S. Harrison. *Bull. Amer. Assoc. Petr. Geol.* **7**, 661.

GEOLOGIC FORMATIONS OF A PART OF SOUTHERN CALIFORNIA AND THEIR CORRELATION.—W. S. Kew. *Bull. Amer. Assoc. Petr. Geol.* **7**, 411.

THE BURKETT-SEMLEY POOL, GREENWOOD COUNTY, KANSAS.—H. Loomis. *Bull. Amer. Assoc. Petr. Geol.* **7**, 482.

RESULTS AND PROSPECTS OF DEEPER DRILLING IN THE ROCKY MOUNTAIN FIELDS.—C. T. Lupton. *Bull. Amer. Assoc. Petr. Geologists* **7**, 400.

PETROLEUM PROSPECTING IN MISSISSIPPI.—P. F. Morse. *Bull. Amer. Assoc. Petr. Geol.* **7**, 684.

POPES BEND STRUCTURE IN TEXAS DRAWS ATTENTION.—*Oil Trade J.* **14**, (12), 32.

MILLER COUNTY, ARK., DRAWS WILDCATTER'S INTEREST.—*Oil Trade J.* **14**, (10), 54.

GEOLOGY AND STRUCTURE OF PORTIONS OF GRAND AND SAN JUAN COUNTIES.—H. W. C. Prommel. *Bull. Amer. Assoc. Petr. Geol.* **7**, 384.

PECULIAR PHASES OF OIL SATURATION IN CERTAIN SANDSTONES.—G. M. Ruby. *Bull. Amer. Assoc. Petr. Geol.* **7**, 473.

THE NEGLIGIBLE OIL POSSIBILITIES OF WISCONSIN.—W. H. Twenhofel. *Bull. Amer. Assoc. Petr. Geol.* **7**, 653.

THE BEARING OF GEOLOGIC FEATURES IN SOUTH DAKOTA UPON OIL POSSIBILITIES.—R. A. Wilson. *Bull. Amer. Assoc. Petr. Geol.* **7**, 507.

ON THE RELATIVE VALUE OF SPECIES OF SMALLER FORAMINIFERA FOR THE RECOGNITION OF STRATIGRAPHIC ZONES.—T. W. Vaughan. *Bull. Amer. Assoc. Petr. Geol.* **7**, 517.

THE NATIONAL RESEARCH COUNCIL AND OIL GEOLOGY.—K. C. Heald. *Bull. Amer. Assoc. Petr. Geol.* **7**, 467.

2. GEOGRAPHICAL.

TRINIDAD OIL INDUSTRY.—A. P. Catherall. *Oil News* **16**, 66. *Petr. Times* **12**, 87.

THE OIL PROSPECTS OF ECUADOR.—*Petr. Times* **12**, 88.

TRINIDAD OIL INDUSTRY: OFFICIAL REPORT FOR 1923.—A. P. Catherall. *Oil News* **16**, 123.

PETROLEUM OF PLAZA HUINCUL.—C. E. Izquierdo. *Anal. Assoc. Quim. Argentina* **11**, 212. *J. Soc. Chem. Ind.* **43**, B586. *Chem. Abstr.* **18**, 2071.

PETROLEUM IN CHINA.—*Petr. Times* **12**, 132.

EXTENT AND CHARACTERISTICS OF NORTHERN ALBERTA BITUMINOUS SANDS.—S. C. Ells. *Nat. Petr. News* **16**, (15), 69. *Chem. Abstr.* **18**, 1964.

PROPERTIES OF TYPICAL CRUDE OILS FROM THE PRODUCING FIELDS OF CALIFORNIA.—A. J. Kramer and H. M. Smith. *U.S. Bureau Mines Repts. Investigations* 2595. *Chem. Abstr.* **18**, 2071.

THE COMPOSITION OF JAPANESE PETROLEUM. II.—S. Komatsu and N. Tanaka. *Mem. Coll. Sci. Kyoto Imp. Univ.* **7**, 143.

HIGH QUALITY CRUDE OIL FROM SLICK SAND.—U.S. Bureau Mines. *Oil Weekly* **33**, (13), 58.

BIG LAKE SHOWING WIDE AREA INTERESTING.—H. H. King. *Oil Weekly* **34**, (5), 30.

POLAND'S OIL INDUSTRY—J. Legendre. *La Revue Pétrolifère* (Special No.). *Oil Engineering and Finance* **5**, 471.

PETROLEUM IN THE PHILIPPINES.—*Standard Oil Bull. Petr. Times* **12**, 186.

THE ROUMANIAN PETROLEUM INDUSTRY.—*Petr. Times* **12**, 187.

THE DEVELOPMENT OF THE DUTCH EAST INDIES OIL INDUSTRY.—C. Lekkerkerker. Commercial Holland. *Petr. Times* **12**, 209.

THE PETROLEUM FIELDS OF ITALY.—*Petr. Times* **12**, 271.

COTTON VALLEY FIELD, LA., EXPECTED TO RIVAL SMACKOVER.—*Oil Trade J.* **15**, (7), 56.

CRUDE FROM SLICK SAND IN TONKAWA FIELD ANALYSED.—*Oil Trade J.* **15**, (7), 72.

PRODUCTION AND CONSUMPTION IN JAPAN.—C. E. Kern. *Oil and Gas J.* **23**, (7-A), 28.

TAR SAND MOUNTAIN IN NORTHERN ALBERTA.—*Oil and Gas J.* **23**, (7-A), 83.

PETROLEUM TRADE OF THE UNITED STATES FOR 1923.—*Dept. of Overseas Trade Rept. Petr. Times* **12**, 294.

THE OIL RESOURCES OF THE BRITISH EMPIRE.—Sir G. Beilby. *Petr. Times* **12**, 313.

DRILLING AND ARCHER COUNTY ATTRACTIVE TO LARGE AND SMALL OPERATORS.—L. E. Smith. *Nat. Petr. News* **16**, (29), 58.

FORMATION OF GASOLINE FROM THE CRUDE OIL OF GBELY.—J. Hladky. *11th Rept. Fuel Ind. Czech. Polytech. Highschool, Prague*, 1922-3. *Chem. Abstr.* **18**, 2242.

CRACKING THE CRUDE OIL OF GBELY.—J. Kouba. *11th Rept. Fuel Tech. Inst. Polytech. Highschool, Prague*, 1922-3, 95. *Chem. Abstr.* **18**, 2242.

563 REFINERIES IN U.S.—C. O. Willson. *Oil and Gas J.* **23**, (25), 58. *Chem. Abstr.* **18**, 2243.

MADAGASCAR AND THE PETROLEUM INDUSTRY. III. THE BITUMINOUS SANDSTONES OF MADAGASCAR.—J. A. Hardel, Petroff, and others. *Chim. et Ind.* **11**, 1003. *Chem. Abstr.* **18**, 2422.

PETROLEUM DEPOSITS IN MAGDALENA VALLEY AND COLUMBIA.—O. Stutzer. *Petroleum* **20**, 659. *Chem. Abstr.* **18**, 2422.

PRODUCTION OF PETROLEUM IN PERU.—F. V. Marsters. *Oil and Gas J.* **23**, (3), 64. *Chem. Abstr.* **18**, 2422.

INVESTIGATION OF THE CRUDE OIL FROM THE "ASTORIA I" WELL IN MRAZNICA (GALICIA).—L. Rosner. *Petroleum* **20**, 733. *Chem. Abstr.* **18**, 2422.

GROWTH OF TRINIDAD OPERATIONS, 1923.—*Petr. World* **21**, 378.

OIL IMPORTS INTO CHINA.—*Petr. World* **21**, 384.

ROUMANIAN OIL INDUSTRY IN 1923.—*Petr. World* **21**, 386.

THE PETROLEUM SITUATION IN NEW MEXICO.—C. T. Kirk and E. G. Woodruff. *Oil Trade J.* **15**, (8), 30.

COTTON VALLEY FIELD'S CONTOUR LINES REVISED.—*Oil Trade J.* **15**, (8), 36.

THE PETROLEUM SITUATION AT BAKU AT THE PRESENT TIME.—Aldebert. *Tech. moderne* **16**, 433. *Chem. Abstr.* **18**, 2599.

ANALYSES OF A FEW CHARACTERISTIC TYPES OF GALICIAN PETROLEUM.—R. Dobrovolski. *Przemysl Chem.* **7**, 67. *Chem. Zentr.* **94**, III., 1550. *Chem. Abstr.* **18**, 2599.

CANADIAN 1923 PRODUCTION LIQUID FUELS.—*Oil News* **16**, 261.

AMERICAN CRUDE OIL PRODUCTION.—*Petr. Times* **12**, 374.

CZECHO-SLOVAKIA'S PETROLEUM IMPORTS FOR 1923.—*Petr. Times* **12**, 374.

A NEW TEXAS OILFIELD.—*Petr. Times* **12**, 374.

NOTHING IN SIGHT IN LOUISIANA-ARKANSAS UNIT OF INDUSTRY TO CAUSE ALARM.—*Nat. Petr. News* **16**, (33), 51.

RESTORING RUSSIAN OIL RESOURCES SATISFACTORILY.—*Oil Weekly* **34**, (7), 28.

REAGAN COUNTY PRODUCTION AREA EXTENDED.—H. H. King. *Oil Weekly* **34**, (7), 49.

ARGENTINE 1923 OIL OUTPUT.—*Oil Paint and Drug Rept.* **106**, (6), 75.

CRUDE PETROLEUM STATISTICS FOR FIVE YEARS ENDED 1923.—*Oil Pain and Drug Rept.* **106**, (6), 56.

CRUDE OIL PIPE LINES OF U.S.—C. E. Bowles. *Oil and Gas J.* **23**, (10-A), 28.

DEVELOPMENT WORK IN NEW MEXICO EXTENDS OIL AREA TOWARDS EAST.—V. H. McNutt. *Oil and Gas J.* **23**, (10-A), 114.

MINING AND REFINING AT PECHELBRONN.—E. C. Isom. *Oil and Gas J.* **23**, (10-A), 124.

SIGNIFICANCE OF THE LARGE OIL FIELDS.—C. E. Bowles. *Oil and Gas J.* **23**, (11-A), 21.

WHEN OIL WORLD FIRST STARTED WESTWARD.—Whit. *Oil and Gas J.* **23**, (11-A), 28.

TULSA OIL POOLS IMPORTANT PRODUCERS.—C. D. Lockwood. *Oil and Gas J.* **23**, (11-A), 36.

RISE IN CALIFORNIA PETROLEUM INDUSTRY.—G. Egloff and A. R. Chandler. *Oil and Gas J.* **23**, (12-A), 21.

CUMBERLAND COUNTY OIL HORIZONS GIVE MANY SOURCES OF PRODUCTION.—L. Beckner. *Oil and Gas J.* **23**, (12-A), 120.

NEW GUINEA: OIL ANALYSIS.—*Oil News* **16**, 303.

RUSSIA'S PETROLEUM INDUSTRY.—W. A. Otis. *U.S. Commerce Rept. Petr. Times* **12**, 405.

THE PETROLEUM FIELDS OF NORTH AFRICA.—*Petr. Times* **12**, 429.

PETROLEUM IN JAPAN.—A. T. Coumbe. *U.S. Bureau Foreign and Domestic Commerce Trade Information Bull.* 245. *Oil Engineering and Finance* **5**, 450, 501.

PETROLEUM IN 1922.—G. B. Richardson. *U.S. Geol. Surv. Mineral Resources of the U.S.*, 1922, Part II., 359.

RECENT DEVELOPMENT OF THE OIL INDUSTRY OF ROUMANIA.—T. V. E. Grigorescu. *Oil Engineering and Finance* **5**, 446, 507.

BIG LAKE FOREBUNNER OF OTHER FIELDS: CRUDE HIGH IN REFINERY YIELDS.—P. Wagner. *Nat. Petr. News* **16**, (35), 29.

NEW ROCKY MOUNTAIN TERRITORY OFFERS LARGE POSSIBILITIES FOR FUTURE.—*Nat. Petr. News* **16**, (35), 53.

OIL POSSIBILITIES IN WESTERN WASHINGTON.—D. Hagar. *Oil and Gas J.* **23**, (13-A), 32.

High Quality Oil in Rosecrans well creates Sensation.—*Oil and Gas J.* **28**, (13-A), 82.

World's Oil Consumption per Head by Countries.—H. S. Fox. *Oil News* **16**, 346.

The Marketing of Crude Petroleum in the United States.—L. M. Fanning. *Eng. and Min. J.-Press. Petr. Times* **12**, 446.

Columbia's Petroleum Industry. *The Lamp. Petr. Times* **12**, 465.

Five Layers of Woodbine at Corsicana.—H. H. King. *Oil Weekly* **34**, (10), 25.

No Menace now in Colorado, New Mexico.—*Oil Weekly* **34**, (10), 35.

Les Gites Pétrolifères Peruviens.—*Le Courrier des Pétroles* **4**, (42), 1.

L'Industrie du Pétrole en Tchécoslaviquie.—*Le Courrier des Pétroles* **4**, (28), 1.

L'Industrie du Pétrole en Roumanie.—*Le Courrier des Pétroles* **4**, (43), 13.

La Roumanie Pétrolifère.—*Le Courrier des Pétroles* **4**, (43), 1.

Le Régime Légal des Recherches de Pétrole.—*Le Courrier des Pétroles* **4**, (41), 2.

The Bellevue Oil Field, Louisiana.—E. Holman and R. B. Campbell. *Bull. Am. Assoc. Petr. Geol.* **7**, 645.

The Roumanian Oil Fields.—S. L. Mason. Am. Assoc. Petr. Geol. *Oil Trade J.* **14**, (11), 64.

Germany's Petroleum Industry.—*Oildom Daily* **15**, (April 7), 3.

The Spring Hill-Sarepta Gas Field, Webster and Bossier Parishes, Louisiana.—G. M. Penton and J. W. Whitehurst.

Smackover Oil Field, Ouachita and Union Counties, Ark.—H. G. Schneider. *Trans. Am. Inst. Min. and Met. Eng.*, 1326-P.

3. Drilling and Field Operations.

Electric Power for Oilfield Purposes.—*Oil Trade J. Petr. Times* **12**, 149.

Why Oil well Casing Parts.—H. P. and F. D. Bostaph. *Petr. World* **21**, 309.

Long Stroke Pump Devices reduce Sucker Rod Breakage.—G. R. Taaffe. *Nat. Petr. News* **16**, (23), 67.

Many Methods used to Flow Oil Wells.—J. M. Lovejoy. *Oil Weekly* **33**, (13), 27.

Worn-out Boiler utilized as Gas Trap proves Economically Effective in Texas Gulf Coast.—*Oil Weekly* **33**, (13), 30.

The Mud Problem in Rotary Drilling.—R. E. Collom. *Oil Weekly* **33**, (13), 37.

FREE FLOW OF OIL ASSURED BY LEIDECKER SAFETY SWAB.—*Oil Weekly* **33**, (13), 89.

REGAN CASING HEAD.—Regan Forge and Eng. Company, San Pedro, California.

NATURAL GAS A FACTOR IN OIL PRODUCTION.—T. E. Swigart. *Oil Weekly*, **34**, (1), 22.

INVESTIGATION REVEALS INTERESTING THREAD DATA.—H. P. and F. D. Bostaph. *Oil Weekly* **34**, (1), 26.

FATALITIES IN THE CALIFORNIA OIL FIELDS.—H. C. Miller. *Oil Weekly* **34**, (1), 30.

EMSCO COMPANY OFFERS NEW ROTARY FOR HEAVY DUTY. *Oil Weekly* **34**, (1), 73.

MUD FLUID IN DRILLING AND PROTECTION OF WELLS.—M. J. Kirwan. *Oil Weekly* **34**, (2), 34.

WHAT VACUUM APPLICATION REALLY DOES.—H. Pennington. *Oil Weekly* **34**, (2), 37.

THE MUD PROBLEM IN ROTARY DRILLING.—R. E. Collom. *Oil Weekly* **34**, (2), 45.

AUTOMATIC LUBRICATOR WINS PRAISE IN CALIFORNIA.—*Oil Weekly* **34**, (2), 90.

MOUNTED RIG GIVES GOOD SERVICE FOR TEST WORK.—*Oil Weekly* **34**, (3), 74.

A.P.I. OUTLINES PLAN ON STANDARDISATION.—*Oil Weekly* **34**, (4), 25.

WAREHOUSE IN RELATION TO PRODUCTION COST.—H. Pennington. *Oil Weekly* **34**, (4), 26.

FREE TRACTION EXCAVATOR GIVES GOOD SERVICE AND LONG WEAR. *Oil Weekly* **34**, (4), 81.

THREE-SPEED DRAW WORKS FOR ROTARY EQUIPMENT.—*Oil Weekly* **34**, (4), 81.

USING WATER TO ASSIST LULING PRODUCTION.—G. Triplett. *Oil Weekly* **34**, (5), 37.

FLOWING DEVICE LENGTHENS FLOWING LIFE OF OIL WELLS.—*Oil Weekly* **34**, (5), 81.

IMPROVEMENT IN LUBRICATOR FOR HUGHES ROCK BITS.—*Oil Weekly* **34**, (5), 81.

WORLD'S ROTARY DRILLING RECORD BROKEN. *California Oil World. Oil News* **16**, 158. *Petr. Times* **12**, 213.

OIL FIELD USE OF ELECTRIC POWER GROWING RAPIDLY.—S. G. Gassaway. *Oil Trade J.* **15**, (7), 27.

LONG STROKE PUMPING AND MEIERS-RESKEY DRIVE.—R. E. D. Foster *Oil Trade J.* **15**, (7), 33.

PIPE THREADING IN OIL FIELD SERVICE.—F. D. Bostaph. *Oil Trade J.* **15**, (7), 40.

NEW AUTOMATIC SPIDER.—*Oil Trade J.* **15**, (7), 66.

ECONOMY OF ELECTRICALLY DRIVEN ROTARY SHOWN ON CALIFORNIA WELL.—*Oil Trade J.* **15**, (7), 85.

STEEL DERRICK STANDS UP UNDER BIG STRAIN.—*Oil and Gas J.* **23**, (6-A), 62.

BIG OIL FIRE EXTINGUISHED WITH WATER.—C. D. Lockwood. *Oil and Gas J.* **23**, (7-A), 36.

NEW SPECIFICATIONS FOR CASING AND OIL COUNTRY TUBULAR GOODS.—*Oil and Gas J.* **23**, (7-A), 92.

LUCK AND SKILL IN OIL WELL FISHING.—R. T. Baker. *Oil and Gas J.* **23**, (8-A), 21.

PLUGGING WELLS WITH LEAD WOOL: METHOD AND MATERIAL DESCRIBED.—*Oil and Gas J.* **23**, (8-A), 72.

ABSORPTION OF NATURAL GAS BY CRUDE PETROLEUM.—D. B. Dow and V. C. E. Roistle. *Min. and Met.* (July). *Petr. Times* **12**, 292.

ADOPT NEW METHOD OF TESTING CASING.—*Nat. Petr. News.* **16**, (27), 71.

FLOW BOXES ARE DEVELOPED IN COTTON VALLEY FIELD.—*Nat. Petr. News* **16**, (27), 71.

WILDCAT USES GASOLINE ENGINE WITH LIGHT ROTARY.—P. Wagner. *Nat. Petr. News* **16**, (28), 43.

EXTRANEOUS GAS IN LYONS-QUINN FIELD INCREASED OIL YIELD 950,000 BLS.—A. F. Hinton. *Nat. Petr. News* **16**, (28), 69.

VALVE TO LUBRICATE ROCK-BIT CONES PERFECTED.—*Nat. Petr News* **16**, (29), 32.

INEFFICIENT HANDLING OF FIELD BOILERS SOURCE OF WASTE AND EXPENSE.—F. G. D. Muller. *Nat. Petr. News* **16**, (29), 77.

STEEL AND CONCRETE RIG FOUNDATION MEET WEST VIRGINIA OPERATOR'S PROBLEM.—*Nat. Petr. News* **16**, (30), 67.

BAKU FIELD PRODUCTION.—S. A. Hamilonoff. *Nat. Petr. News* **16**, (30), 78.

UNION OIL NOW HOLDS TITLE FOR DEEPEST ROTARY DRILLING.—*Nat. Petr. News* **16**, (31), 75.

INFLUENCES RELATED TO THE USE OF CEMENT IN (OIL) WELLS.—L. T. Bachman. *Oil Weekly* **32**, (5), 25; (6), 27. *Chem. Abstr.* **18**, 2230.

RECOVERY OF PETROLEUM AT PECHELBRONN.—C. Camsell and A. Buisson. *Petr. Times* **11**, 635. *Chem. Abstr.* **18**, 2241.

THE DEEPEST ROTARY WELL IN THE WORLD.—*Petr. Times* **12**, 344.

COSTS AND HAZARDS OF OIL PRODUCTION.—*Oil Weekly* **34**, (6), 52.

EMSCO HOIST GIVES GOOD SERVICE IN FIELD TESTS.—*Oil Weekly* **34**, (6), 81.

BEAUMONT SWIVEL CONTROLS PUMP PRESSURE ON PACKING.—*Oil Weekly* **34**, (6), 81.

ELECTRIC PUMPING OUTFIT USED BY GULF COAST CO. PROVES MONEY SAVER.—*Oil Weekly* **34**, (6), 82.

UNION OIL ABANDONS WORLD'S DEEPEST WELL AT 7319 FT.—*Oil Trade J.* **15**, (8), 27.

TESTING OF WORK BARRELS INCREASES PUMPING EFFICIENCY.—*Oil Trade J.* **15**, (8), 44.

IMPROVED VALVE FOR USE WITH HUGHES LUBRICATOR ANNOUNCED.—*Oil Trade J.* **15**, (8), 56.

PORTABLE DRILLING RIG MADE BY HOWARD SMITH CO.—*Oil Trade J.* **15**, (8), 56.

NEW DRILLING OUTFIT.—*Petr. Age* **13**, (10), 70.

CURING ILLS OF DEEP PUMPING.—G. R. Taaffe. *Petr. Age* **13**, (11), 58.

"PEPPING UP" OLD OIL WELLS.—*Petr. Age* **14**, (2), 15.

THE MOST PRODUCTIVE WELL IN THE WORLD.—*Petr. Times* **12**, 372.

MINING FOR OIL NEAR WIETZE, HANOVER.—*Petr. Times* **12**, 391.

CALIFORNIA CASING STANDARDISATION IS NOW PARTLY IN EFFECT.—*Nat. Petr. News* **16**, (32), 44.

ATTEMPT TO DRAIN B.S. FROM LEASE TANKS OFTEN IS COSTLY.—A. B. Morris. *Nat. Petr. News* **16**, (32), 75.

TIME BOMB SUCCESSFUL IN FIRING SHOTS.—*Nat. Petr. News* **16**, (33), 77.

PORTABLE OUTFIT FOR CLEANING WELLS WITH AIR SUCCESSFULLY USED.—J. O. Lewis. *Nat. Petr. News* **16**, (33), 83.

CAUSES AND PREVENTIVES OF CASING COLLAPSE.—H. Pennington. *Oil Weekly* **34**, (7), 25.

LONG STROKE PUMPER GIVES SUCCESS IN CALIFORNIA.—*Oil Weekly* **34**, (7), 81.

THE DEVELOPMENT OF AN IDEA.—Lufkin Foundry and Machine Co., Lufkin, Texas. *Oil Weekly* **34**, (7), 81.

EMSCO DISC BIT EMBODIES SEVERAL GOOD FEATURES.—*Oil Weekly* **34**, (7), 81.

REGULATES OIL FEED TO ROCK-BIT CONES.—*Oil and Gas J.* **23**, (10-A). 94.

OIL WELL PACKERS DATE BACK TO DRILLING OF THE OLD DRAKE WELL.—R. T. Baker. *Oil and Gas J.* **23**, (12-A), 76.

HILD DIFFERENTIAL DRIVE OFFERS NEW ELECTRIC ROTARY METHOD.—L. H. Keim. *Oil and Gas J.* **23**, (12-A), 82.

GEOLOGIST REPORTS AGAINST SHOOTING OF FLOOD WELLS.—*Oil and Gas J.* **23**, (12-A), 147.

FIELD METHODS IN RUSSIA.—W. A. Otis. *U.S. Bur. Commerce Rept. Oil News* **16**, 293.

A New Dunn Bushingless Tong.—*Petr. Times* **12**, 410.

Effects of Extraneous Gas on the Production of Oil Wells in the Lyons-Quinn Field of Oklahoma.—M. J. Kirwan. *U.S. Bureau Mines Repts. Investigations* 2612. *Oil and Gas J.* **23**, (8-A), 32. *Petr. Times* **12**, 126.

Simple Method of Keeping Field Records.—C. W. Craig. *Oil Weekly* **34**, (9), 43.

Using Lead Wool for Shutting off Water—How to do Successful Job.—*Oil Weekly* **34**, (9), 46.

Mechanical Transmission of Power through Chains.—C. R. Weiss. *Oil and Gas J.* **23**, (13-A), 111.

Mechanical Control of High Pressure Oil Wells.—A. J. Mason. *Petr. Times* **32**, 481.

A Study of Bit Steel used in Oil Drilling.—*Petr. Times* **12**, 489.

Taking Cores on Geological Formations with Modern Drilling Systems.—*Petr. Times* **12**, 503.

Gasoline Rig used with Success at Goose Creek.—*Oil Weekly* **34**, (10), 73.

Combination Safety Valve and Control Head announced.—*Oil Weekly* **34**, (10), 74.

Simple Contrivance gets Double Duty from Engine.—*Oil Weekly* **34**, (10), 74.

Novel Equipment used on Texas Wildcat.—F. Ennist. *Oil Trade J.* **14**, (7), 36.

Bailing Machine with Two-pole Derrick used for Pulling and Cleaning out Wells.—W. A. Hovis. *Gas Ind.* **17**, 380.

Well Engines made from Old Automobiles.—D. J. Stokes. *Gas Ind.* **17**, 261.

Drilling Wells with a Diamond Core Drill.—F. R. Rees. *Oil Trade J.* **34**, (12), 70.

Making the Petroleum Industry Safe.—R. T. Baker. *Oil and Gas J.* **23**, (5), 76.

Fishing Tool.—C. H. Brown. *Sci. Am. Monthly* **129**, 346.

Removal of Paraffin from Oil Wells.—R. Van A. Mills. *Oil and Gas J.* **23**, (5), 28.

One Method of Completing a Junked Hole with the Diamond Bit.—*Oil Age* **21**, (1), 45.

Bottom Water more easily Plugged than that in an Oil Sand.—*Oil and Gas J.* **22**, (5), 96.

Dolbear Well Fire extinguished with Difficulty.—*Oil Trade J.* **14**, (10), 80.

THE USE OF FLUIDS IN CLEANING OIL WELLS.—L. Suverkrop. *Monthly Chapter, 9th Annual Rept. State Oil and Gas Supervisor, California State Min. Bureau* (Jan.), 5.

NEW DRIVE IN DRILLING.—L. H. Keim. *Petr. Age* **34**, (4), 54. *Oil News* **16**, 243.

PATENTS.

APPARATUS FOR SEPARATING GAS FROM OIL AS DELIVERED FROM WELLS.—R. Conrader. U.S. Pat. 1,492,963. *Chem. Abstr.* **18**, 2072. *Nat. Petr. News* **16**, (29), 89.

SEPARATOR FOR USE IN CONNECTION WITH AN OIL WELL.—W. M. Marker and W. R. Allen. U.S. Pat. 1,496,090. *Nat. Petr. News* **16**, (33), 75.

OIL-WELL DRILLING RIG.—G. G. Cecil. U.S. Pat. 1,492,833. *Nat. Petr. News* **16**, (29), 89.

OIL PUMP.—W. T. Kauffman. U.S. Pat. 1,493,267. *Nat. Petr. News* **16**, (29), 89.

FINGER BOARD FOR OIL-WELL DERRICKS.—A. L. and J. M. Owen. U.S. Pat. 1,494,324. *Nat. Petr. News* **16**, (29), 89.

APPARATUS FOR SEPARATING WATER, OIL AND GAS AS THEY FLOW FROM OIL WELLS.—A. J. Delaney and H. F. Rasmeor. U.S. Pat. 1,494,670.

PROCESS OF RECEIVING VOLATILE FLUIDS (FROM PETROLEUM).—J. C. Bertsch, Assr. to The Bertsch Process Co. U.S. Pat. 1,498,069. *J. Soc. Chem. Ind.* **43**, B704.

SWINGING LATCH ELEVATOR.—E. C. Wilson. U.S. Pat. 1,198,141. *Oil Weekly* **34**, (6), 81.

CLEANING MUD COLLOIDS FROM WELLS.—F. W. Lake and R. W. Phelps. U.S. Pat. 1,498,045. *Chem. Abstr.* **18**, 2599.

SEPARATING OIL FROM SAND.—A. Stroppel, assgd. to Deutsch Erdol Aktiengesellschaft. U.S. Pat. 1,497,607. *Nat. Petr. News* **16**, (33), 75.

OIL PURIFIER.—S. L. Marsh. U.S. Pat. 1,496,160. *Nat. Petr. News* **16**, (33), 75.

4. PIPE-LINES, TRANSPORT AND STORAGE.

"FIRE SUDS" QUICKLY EXTINGUISH OIL FIRE.—*Oil News*, **16**, 68.

CENTRIFUGAL PUMPS HANDLE OIL IN CALIFORNIA.—W. E. Green. *Oil Weekly* **33**, (13), 19.

TANKS FOR OIL STORAGE.—Pittsburgh Des Moines Steel Co., Pittsburgh.

PROPER GROUNDING NECESSARY FOR TANKS.—*Oil Weekly* **34** (3), 27.

THE INSULATION OF OIL STORAGE TANKS.—Celite Products Co.

SCRAPER CALLED "GO-DEVIL" CLEANS PIPE-LINES.—*Nat. Petr. News* **16**, (27), 73.

TANKAGE INSTALLATION HOLDS ALL GAS FROM WELL TO PIPE-LINE.—L. E. Smith. *Nat. Petr. News* **16**, (28), 58.

TANK FITTINGS ON WOOD OR INSULATED ROOFS MUST BE GROUNDED.—*Nat. Petr. News*, **16**, (30), 75.

SYSTEM FOR MEASURING FIRE HAZARD OF TANKS, STILLS AND CONTENTS.—*Nat. Petr. News* **16**, (30), 83; (31), 85.

METHODS FOR DETERMINING THE VENTING NEEDS OF STORAGE TANKS.—S. H. Brooks. *Nat. Petr. News*, **16**, (20), 55.

SOME FACTORS IN OIL LEASE OPERATION.—H. P. Porter. *Nat. Petr. News* **16**, (21), 77. *Chem. Abstr.* **18**, 2244.

NEW USES FOR CEMENT IN OIL STORAGE.—R. T. Baker. *Oil and Gas. J.* **23**, (8), 36. *Chem. Abstr.* **18**, 2425.

STORAGE OF INFLAMMABLE LIQUIDS.—A. Neuberger. *Chem. Zeit.* **48**, 277. *Chem. Abstr.* **18**, 2429.

MODERN REINFORCED CONCRETE STORAGE.—*Le Courrier des Petroles. Oil News* **16**, 233.

BIG WELDED GAS LINE COMPLETED IN MID-CONTINENT.—*Oil Trade J.* **15**, (8), 40.

MORE GASOLINE BY USE OF NATURAL EVAPORATION.—Vacuum Control Co., Topeka, Kans.

WELDED TANKS SERVE EXPORT STATION.—*Ref. and Nat. Gas. Mfr.* **3**, (8), 33.

AID TO "GAS TIGHT" OWNERS.—*Petr. Age*, **14**, (2), 54.

THWARTING THE UNSEEN THIEF.—J. H. Wiggins. *Petr. Age* **14**, (4), 16.

ELECTRIC WELDING OF LARGE STORAGE TANKS.—H. E. Price. Am. Inst. of Mining and Met. Engr. Welding Engineering Co., Bartlesville, Okla. *Oil and Gas J.* **23**, (10-A), 94; (12-A), 82.

ARE EXTINGUISHING OIL FIRES BY USING LIQUID CARBON DIOXIDE.—W. H. Freygang. *Oil and Gas J.* **23**, (12-A), 86.

THE RECENT FLUSHING OIL FIRE.—*Petr. Times* **12**, 415.

TANKS.—Lancaster Iron Works, 101, Hager Street, Lancaster, Pa.

CONCRETE OIL TANKS.—*Oil Eng. and Finance* **5**, 521.

THE SCAMMELL SIX-WHEELER IN THE PERSIAN OILFIELDS.—*Petr. Times* **12**, 487.

TANK.—A. B. Cooper. *Sci. Am. Monthly* **199**, 346.

NATURAL GAS GASOLINE EVAPORATION ONE OF LARGEST PREVENTABLE LOSSES. *Oil and Gas J.* **23**, (2), 60.

ERECTING TANKS TO STORE GASOLINE.—*Oil and Gas. J.* **23**, (5), 62.

NOTES ON EFFICIENCY IN OPERATION OF OIL TANKERS.—T. J. Smith. *Marin Eng.* **28**, 477.

PATENTS.

COMPOSITION FOR FOAMS.—J. M. Jennings, Assr. to Standard Development Co. U.S. Pat. 1,495,308. *J. Soc. Chem. Ind.* **43**, B622. *Chem. Abstr.* **18**, 2804.

COVER AND CONDENSER FOR STORAGE TANKS FOR HOLDING GASOLINE, CRUDE OIL OR SIMILAR LIQUIDS.—J. R. Hill. U.S. Pat. 1,493,544.

GAS TRAP FOR OIL STORAGE TANKS.—F. A. Ray. U.S. Pat. 1,492,579. *Chem. Abstr.* **18**, 2072. *Nat. Petr. News* **16**, (29), 89.

5. REFINERY TECHNIQUE.

VOLATILE YELLOW COLOURING MATTER IN CRACKED GASOLINES.—B. T. Brooks and H. O. Parker. *Ind. and Eng. Chem.* **16**, 587. *J. Soc. Chem. Ind.* **43**, B624.

HYDROCHLORITE PROCESSES AND CHEMICALS FOR PETROLEUM INDUSTRY. Mathieson Alkali Works, Inc., New York.

RECOVERY OF SEPARATED SLUDGE ACID.—Catalogue 5. Chemical Construction Co., New York.

ADVANCES IN PETROLEUM TECHNOLOGY.—J. V. Braun. *Z. für angew. Chem.* **37**, 357.

DISTILLING CRUDE UNDER REDUCED PRESSURE.—G. Triplett. *Ref. and Nat. Gas. Mfr.* **3**, (7), 11.

HEAT TRANSFER IN SMALL PIPES.—F. C. Blake and W. A. Peters. *Ind. and Eng. Chem.* **16**, 845.

USE OF HYPOCHLORITE SOLUTION FINDS FAVOUR.—L. T. Bradley. *Ref. and Nat. Gas. Mfr.* **3**, (7), 25.

SILICA GEL ADSORPTION, PARTICULARLY IN REFINING PETROLEUMS.—R. Kœtschau. *Chem. Zeit.* **43**, 497, 518. *Petr. Times* **12**, 268. *Chem. and Met. Eng.* **31**, 356.

ULTRA-PURIFICATION OF PETROLEUM WITH CHINA CLAY.—Matières Grasses (April). *Chem. Age* (*China Clay Trade Rev. Section*) **11**, (270), 8.

TREATMENT OF OIL FOR REFINERY USE.—R. T. Baker. *Oil and Gas J.* **23**, (9-A), 84.

DEEPWATER OIL REFINERIES, INC. INSTALL VACUUM PROCESS.—*Nat. Petr. News* **16**, (29), 25.

SYSTEM FOR MEASURING FIRE HAZARD OF TANKS, STILLS AND CONTENTS.—*Nat. Petr. News* **16**, (30), 83, (31), 85.

FINANCIAL CONSIDERATIONS GOVERNING THE REFINING OF MEXICAN CRUDE OIL.—J. E. Hackford. *Oil Eng. and Finance* **5**, 301. *Chem. Abstr.* **18**, 2242.

REFINING CRACKED CALIFORNIA DISTILLATES INTO MARKETABLE WATER WHITE GASOLINE.—G. Egloff and J. C. Morrell. *Petr. World* (Calif.) **9**, (2), 24. *Chem. Abstr.* **18**, 2243.

MAKING THE REFINERY SHOW A PROFIT BY REDUCING OPERATING COSTS.—V. P. Truesdell. *Nat. Petr. News* **16**, (18), 67.

THE REFINING OF TRANSFORMER OILS.—J. Hladky. *11th Rept. Fuel Tech. Inst. Czech. Polytech. Highschool, Prague*, 1922–3. *Chem. Abstr.* **18**, 2243.

SILICA GEL.—L. Singer. *Petroleum* **20**, 279. *Chem. Abstr.* **18**, 2424.

SILICA GEL.—E. Kroch. *Petroleum* **20**, 732. *Chem. Abstr.* **18**, 2424.

REFINING PETROLEUM WITH LIQUID SULPHUR DIOXIDE.—W. Peters. *Chem. Tech. Zeit.* **42**, 57.

DECOLORISING MINERAL OILS.—H. Moore. *Oil Eng. and Finance* **5**, 357. *Chem. Abstr.* **18**, 2424.

CONTRACT FILTRATION LIKELY TO BECOME IMPORTANT FEATURE IN REFINING.—W. S. Zehrung. *Nat. Petr. News* **16**, (23), 27. *Chem. Abstr.* **18**, 2424.

ACID TREATMENT OF KEROSENE DISTILLATES.—W. M. Fraser. *Oil and Gas J.* **23**, (2), 100. *Chem. Abstr.* **18**, 2424.

THERMAL AND PHYSICAL VALUES OF STILL INSULATION.—L. C. Converse. *Nat. Petr. News* **16**, (24), 87. *Chem. Abstr.* **18**, 2424.

OPERATING EFFICIENCY IN THE PETROLEUM INDUSTRY.—M. Morgenstein. *Petroleum* **20**, 725. *Chem. Abstr.* **18**, 2424.

CALIFORNIA DEVELOPMENT IN THE PREPARATION AND USE OF ADSORPTIVE CLAYS IN REFINING.—C. J. von Bibra. *Ref. and Nat. Gas. Mfr.* **3**, (7), 15. *Petr. World* **21**, 359.

PETROL AND ITS DERIVATIVES. Parts I. and II.—P. de Chambrier. *Matières grasses* **17**, 6817, 6844. *Chem. Abstr.* **18**, 2802.

NEW PROCESS FOR MAKING "LUBS" HAS ADVANTAGES.—*Oil Trade J.* **15**, (8), 29.

CONTRACT FILTERING IN OIL REFINING FAVOURED.—*Oil Trade J.* **15**, (8), 38.

POWER COSTS REDUCED BY ELECTRIC DRIVE.—H. Pennington. *Ref. and Nat. Gas. Mfr.* **3**, (8), 11.

CORRECT METHODS SHOULD BE FOLLOWED WHEN SENDING SAMPLES TO LABORATORY.—R. C. Osterstorm. *Ref. and Nat. Gas. Mfr.* **3**, (8), 16.

HOW TO TREAT DISCOLOURED GASOLINE.—O. Peters. *Ref. and Nat. Gas. Mfr.* **3**, (8), 17.

HEAT LOSSES FROM STEAM-LINE PIPES.—R. H. Heilman. *Blast Furnace Steel Plant* **10**, 261. *Chem. Abstr.* **18**, 2568.

SILICA GEL; A NEW MEDIUM FOR ABSORBING GASES AND LIQUIDS.—W. Paulsen. *Der Apparatebau* **36**, 128. *Chem. Abstr.* **18**, 2583.

PRESENCE OF CHLORINE IN MOTOR SPIRITS.—S. Lawson. *Oil Eng. and Finance* **5**, 363. *Chem. Abstr.* **18**, 2599.

METHODS OF TREATING LUBRICATING OILS.—C. J. von Bibra. *Ref. and Nat. Gas. Mfr.* **3**, (6), 9. *Chem. Abstr.* **18**, 2600.

THE ELECTRIC PROCESS FOR THE DEHYDRATION OF CRUDE OIL EMULSIONS.—A. J. Houston. *Oil News* **16**, 289. *Petr. Times* **12**, 453.

DESULPHURISATION OF MINERAL OIL DISTILLATES BY MEANS OF HYPOCHLORITE.—H. I. Waterman and J. H. Heimel. *Chem. Weekblad* **21**, 374. *J. Soc. Chem. Ind.* **43**, B739.

CATALYTIC TREATMENT OF CRACKED DISTILLATES IN THE VAPOUR PHASE.—T. T. Gray and M. R. Mandebaum. *Ind. and Eng. Chem.* **16**, 913.

LULING FIELD HAS LARGEST ELECTRIC DEHYDRATING PLANT IN THE WORLD. —*Oil Weekly* **34**, (10), 55.

APPLICATION OF THE CLOSED CALORIFIC CIRCUIT HEATING SYSTEM TO DISTILLATION IN THE CHEMICAL INDUSTRY.—C. Mariller. *Chim. et Ind.* **11**, 262. *J. Soc. Chem. Ind.* **43**, B773.

DESULPHURISATION OF MEXICAN OIL DISTILLATES BY THE "DOCTOR TREATMENT."—D. W. Sissingh. *Brennstoff Chem.* **5**, 234. *J. Soc. Chem. Ind.* **43**, B776.

TREATMENT OF PARAFFIN WAX WITH STEAM.—R. von Walther and H. Steinbrecher. *Braunkohlenarchiv* **7**, 10. *Chem. Zentr.* **95**, II, 1042. *J. Soc. Chem. Ind.* **43**, B777.

TECHNICAL USES OF BAUXITE IN CONNECTION WITH PETROLEUM REFINING. —A. M. O'Brien. *J. Soc. Chem. Ind.* **43**, 188T. *Chem. Abstr.* **18**, 2802.

BAUXITE AS A REFINING AGENT FOR PETROLEUM DISTILLATION. A. E. Dunstan, F. B. Thole and F. G. P. Remfry. *J. Soc. Chem. Ind.* **43**, 179. *Chem. Abstr.* **18**, 2802.

PURIFICATION OF LIQUIDS BY CENTRIFUGATION.—A. F. Meston. *Chem. Age (N.Y.)* **31**, 370.

REFINING OF ROUMANIAN CRUDE OIL ANALYSED.—*Oil Trade J.* **14**, (11), 68.

PATENTS.

REFINING HYDROCARBONS.—H. Hütz. Ger. Pat. 392,142. *J. Soc. Chem. Ind.* **43**, B 589.

PROCESS FOR THE PREVENTION OF THE FORMATION OF EMULSIONS.—H. A. Gill. From the Sharples Speciality Co. Brit. Pat. 215,929. *J. Soc. Chem. Ind.* **43**, B 589. *Chem. Age* **15**, 652.

SEPARATING OIL FROM SAND.—A. Streppel, Assr. to Deutsche Erdöl A.G. U.S. Pat. 1,497,607. *J. Soc. Chem. Ind.* **43**, B 626. *Ref. and Nat. Gas Mfr.* **3**, (7), 41.

REVIVIFYING, DECOLOURISING OR CLARIFYING CLAYS.—M. L. Chappell, E. P. Wright and M. M. Moore. U.S. Pat. 1,488,895. *Chem. Abstr.* **18** 2062. *J. Soc. Chem. Ind.* **43**, B 460.

PURIFYING CRACKED GASOLINE.—A. E. Dunstan. U.S. Pat. 1,492,969. *Chem. Abstr.* **18**, 2072. *J. Soc. Chem. Ind.* **43**, B 503.

DETERGENT SULPHONATES FROM OIL REFINING.—R. E. Divine. U.S. Pat. 1,493,111. *Chem. Abstr.* **18**, 2073.

PURIFICATION OF HYDROCARBONS, PARTICULARLY LIGHTER PETROLEUM FRACTIONS.—H. D. Demoulins and F. H. Garner. Brit. Pat. 216,918. *J. Soc. Chem. Ind.* **43**, B 665. *Chem. Age* **11**, 44.

PURIFYING MINERAL OILS.—F. G. P. Remfry. Brit. Pat. 212,500. *Chem. Abstr.* **18**, 2245. *Oil Engineering and Finance* **3**, 341. *J. Soc. Chem. Ind.* **43**, B 459. *Chem. Age* **10**, 415.

EMULSIFYING HYDROCARBONS OR OTHER SUBSTANCES.—H. Bechhold, L. Gutlohn and H. Karplus. Brit. Pat. 213,590. *Chem. Abstr.* **18**, 2426.

PURIFYING MINERAL OILS.—Union Oil Co. of Cal. Brit. Pat. 213,881. *Chem. Abstr.* **18**, 2426. *Chem. Age* **10**, 603.

TREATMENT OF HYDROCARBONS, PARTICULARLY OF CRUDE PETROLEUM. W. Dederich. From P. von Ditmar. Brit. Pat. 191,037.

DESULPHURISING MINERAL OILS AND OIL-BEARING SUBSTANCES.—G. E. Heyl. Brit. Pat. 213,946. *Chem. Abstr.* **18**, 2600. *J. Soc Chem. Ind.* **43**, B 503. *Oil Engineering and Finance* **5**, 420.

PURIFYING AND DEODORISING ISOPROPYL ALCOHOL.—H. E. Buc, Assr. to Standard Development Co. U.S. Pat. 1,498,229. *J. Soc. Chem. Ind.* **43**, B 732.

KIESELGUHR FILTER-AID.—C. F. Ritchie, assgd. to Celite Co. U.S. Pat. 1,503,133. *Chem. and Met. Eng.* **31**, 355.

PURIFYING MINERAL OILS.—T. Bullinger, M. Melhardt, H. Wiese, H. Winternitz and E. Zerner. Brit. Pat. 218,989. *Chem. Age*, **11**, 298.

DISTILLING HYDROCARBON OILS.—J. Tausz. Brit. Pat. 219,322. *Chem. Age* **11**, 299.

DECOLORISING MINERAL OILS.—F. W. Manning, assgd. to Manning Refining Co. U.S. Pat. 1,504,772. *Chem. and Met. Eng.* **31**, 432.

PROCESS OF PURIFYING MINERAL OIL.—E. Petty, Assr. to De Laval Separator Co. U.S. Pat. 1,500,202. *J. Soc. Chem. Ind.* **43**, B 779. *Chem. Abstr.* **18**, 2804.

PROCESS FOR DE-EMULSIFYING LIQUIDS (OIL EMULSIONS).—C. V. Zoul. U.S. Pat. 1,501,877. *J. Soc. Chem. Ind.* **43**, B 779.

METHOD OF OBTAINING STABLE AQUEOUS EMULSIONS OF PITCH AND OTHER UNSAPONIFIABLE MATTERS.—F. C. Thornley, F. F. Tapping and O. Reynard. Brit. Pat. 219,348. *J. Soc. Chem. Ind.* **43**, B 780.

PURIFYING MINERAL OILS.—O. D. Lucas and V. L. Oil Processes, Ltd. Brit. Pat. 214,871. *Chem. Abstr.* **18**, 2804.

DESULPHURISING HYDROCARBON OILS.—Anglo-Saxon Petroleum Co., Ltd. (E. S. Hillman.) Brit. Pat. 214,733. *Chem. Abstr.* **18**, 2804. *Chem. Age* **10**, 577. *J. Soc. Chem. Ind.* **43**, B 550.

FAT-SPLITTING SULPHONIC ACIDS.—R. E. Divine. U.S. Pat. 1,495,891. *Chem. Abstr.* **18**, 2804.

6. Natural Gas.

Natural-gas Gasoline in 1922.—G. B. Richardson. *U.S. Geol. Surv. Mineral Resources of U.S.* 1922, Pt. 11, 347.

Vertical Evaporator in the Steam Distillation of Natural Gasoline. —*Ref. and Nat. Gas. Mfr.* **3**, (7), 46.

Analysis of Gases in Canadian Wells.—*Oil and Gas J.* **23**, (7-A), 66.

Operators Talk Gasoline Plant Problems at Association Field Conference.—J. C. Chatfield. *Nat. Petr. News* **16**, (27), 32A.

Natural-gas developments during 1923.—E. G. Sievers. *Gas Age-Record* **53**, 635.

Improved Casinghead Processes Have Marked Industry's Development.—E. H. Adams. *Petr. World (Calif.)* **9**, (5), 100. *Chem. Abstr.* **18**, 2243.

Methods Used by California Operators.—C. J. von Bibra. *Ref. and Nat. Gas. Mfr.* **3**, (5), 13. *Chem. Abstr.* **18**, 2243.

Larger and Better Recovery by Stabiliser.—L. F. Bayer. *Oil and Gas. J.* **23**, (22), 92. *Chem. Abstr.* **18**, 2243.

Operation of Ideal Absorption Plant.—D. E. Foster. *Oil and Gas J.* **23**, (8), 20. *Chem. Abstr.* **18**, 2423.

Natural Gasoline Plant Development.—R. T. Baker. *Oil and Gas J.* **23**, (26), 100. *Chem. Abstr.* **18**, 2423.

New Type of Natural Gasoline Plant.—R. T. Baker. *Oil and Gas J.* **23**, (3A), 116. *Chem. Abstr.* **18**, 2424.

Natural Gasoline Colour Affected by Compressor Lubrication.—O. Peters. *Nat. Petr. News* **16**, (32), 27.

Canada's Helium Resources.—*Oil Paint and Drug Reptr.* **106**, (6), 67.

Treating Discoloured Gasoline; Traced to the Low Stage Maker.—O. Peters. *Oil and Gas. J.* **23**, (11-A), 90.

Charcoal Absorption Plant Process.—R. T. Baker. *Oil and Gas J.* **23**, (12-A), 108.

Natural Gas in Alberta.—*Canad. Dept. Mines Rept.* 616A. *Oil News* **16**, 318.

The Absorption of Gasoline from Natural Gas.—R. P. Anderso . *Chem. and Met. Eng.* **31**, 420.

The Monroe Gas Field, Louisiana.—B. K. Stroud and F. P. Shayes. *Bull. Amer. Assoc. Petr. Geol.* **7**, 565.

Maintaining a Supply of Natural Gas.—H. A. Fisher. *Gas. Ind.* **17**, 324.

How Natural Gasoline Plants are Converted.—L. F. Bayer. *Oil Trade J.* **14**, (9), 74.

NATURAL GAS ENGINEERING.—E. J. Stephany. *Gas Ind.* **17**, 390.

GAS PRODUCTION FROM THE SPRING HILL-SAREPTA GAS FIELD, WEBSTER AND BOSSIER PARISHES, LOUISIANA.—G. Beldric and C. A. Breitung. *Bull. Amer. Assoc. Petr. Geol.* **7**, 555.

THE OIL IN NATURAL GAS OF REFUGIO COUNTY, TEXAS.—L. A. Thiele. *Chem. Age (New York)* **31**, 415.

RESIDUE FROM CASINGHEAD GAS ONCE WASTED NOW REVENUE SOURCE.—H. M. Houston and J. B. O'Connor. *Oil and Gas J.* **23**, (5), 36.

CANADIAN HELIUM TEST BY CHEMICAL SOCIETY.—*Oil and Gas J.* **23**, (12-A), 78.

PATENTS.

GASOLINE FROM NATURAL GAS.—T. A. Stancliff. U.S. Pat. 1,493,871. *Chem. Abstr.* **18**, 2072. *Nat. Petr. News* **16**, (29), 89.

TREATMENT OF NATURAL GASES.—G. Claude and E. Jordan, Assrs. to Soc. L'Air Liquide. U.S. Pat. 1,497,546. *J. Soc. Chem. Ind.* **43**, B 665. *Chem. Abstr.* **18**, 2421.

GASOLINE FROM HYDROCARBON GASES.—N. E. Loomis. (Assgd. to Standard Development Co.) U.S. Pat. 1,493,061. *Chem. Abstr.* **18**, 2426. *Nat. Petr. News* **16**, (33), 75. *J. Soc. Chem. Ind.* 434, B 626. *Chem. and Met. Eng.* **31**, 198. *Ref. and Nat. Gas. Mfr.* **3**, (7), 41.

CARBON BLACK.—J. A. McGuire. U.S. Pat. 1,498,924. *Chem. Abstr.* **18**, 2585.

7. PETROL AND OTHER MOTOR FUELS.

NAVY ASKS REFINERS FOR ANTI-KNOCK FUEL FOR AIRPLANES.—*Nat. Petr. News* **16**, (30), 21; (31), 81.

METHODS OF ENERGISING GASOLINE.—R. Cross. *Oil and Gas News* **14**, (4), 22. *Chem. Abstr.* **18**, 2244.

A COMMENTARY ON GASOLINE SPECIFICATIONS.—E. H. Leslie. *Oil News* **12**, (6), 13. *Chem. Abstr.* **18**, 2423.

CATALYSIS AND THE INTERNAL COMBUSTION ENGINE.—E. Sokal. *J. Soc. Chem. Ind.* **43**, 283T.

DECOMPOSITION OF LEAD TETRA-ETHYL AND ITS APPLICATION TO EXPLOSION ENGINES.—P. Jolibois and G. Normand. *Compt. rend.* **179**, 27. *J. Soc. Chem. Ind.* **43**, B 700.

GASOLINE VOLATILITY REDUCED BY CRANK CASE DILUTION.—*Oil Trade J.* **15**, (8), 38.

THE RATE OF HEAT TRANSMISSION FROM THE WORKING FLUID IN AN INTERNAL COMBUSTION ENGINE.—A. H. Gibson. *Phil. Mag.* **47**, 883. *Chem. Abstr.* **18**, 2456.

THE PROBLEM OF A NATIONAL MOTOR FUEL.—P. Chiaria. *Giorn. farm. chim.* **73**, 105. *Chem. Abstr.* **18**, 2594.

TETRA-ETHYL LEAD CLAIMED TO HAVE PROPERTY OF REDUCING AUTO KNOCKS.—A. P. Bjerregaard. *Oil and Gas J.* **23**, (12-A), 125.

SAVING GASOLINE AND INCREASING MILEAGE BY PROPER CARBURETTOR ADJUSTMENT.—G. W. Jones and A. A. Straub. *U.S. Bureau Mines Repts. Investigations* 2616.

CARBURATION—THEORY AND PRACTICE.—R. W. A. Brewer. Crosby Lockwood and Son, London.

"IT'S SECRET" STATES BOYCE, WHEN ASKED FOR PROOF OF BOYCE-ITE CLAIMS.—*Nat. Petr. News* **16**, (35), 33.

(LOW-TEMPERATURE) TAR OILS AS MOTOR FUELS.—F. Hausser and H. Ellerbusch. *Auto-Technik* **13**, 29. *Chem. Zentr.* **95**, II, 782. *J. Soc. Chem. Ind.* **43**, B 776.

LES COMBUSTIBLES LIQUIDES ET LE PROBLÈME DU CARBURANT NATIONAL —Aubert. Gauthier-Villars et Cie, Paris.

RECENT GERMAN CARBURETOR DESIGNS STRESS USE OF CHEAPER FUELS.—B. R. Dierfield. *Auto. Ind.* **49**, 177.

LE CARBURANT NATIONAL: ETUDE SUR SA CONSTITUTION POSSIBLE.—C. Legrand. *Chim. et Ind.* **10**, 411.

FEEDING THE AUTOMOBILE ENGINE.—*Scient. Amer. Monthly* **129**, 338.

PARIS BUSES TEST EFFICIENCY OF ALCOHOL AS ENGINE FUEL.—*Auto. Ind.* **49**, 257.

ALCOHOL AS MOTOR FUEL.—E. Holtan. *Papir-Journalen* **12**, 13, 26, 37. *Chem. Abstr.* **18**, 2797.

PATENTS.

MOTOR FUEL COMPOSITION.—D. B. Keyes. Assgd. to U.S. Industrial Alcohol Co. U.S. Pat. 1,496,810. *Chem. and Met. Eng.* **31**, 24. *J. Soc. Chem. Ind.* **43**, B 665. *Chem. Abstr.* **18**, 2421.

PREPARATION OF A CARBURETTING FUEL MIXTURE FOR INTERNAL COMBUSTION ENGINES.—H. Terrisse. Brit Pat. 216,169. *J. Soc. Chem. Ind.* **43**, B 626.

MOTOR FUEL.—R. H. McKee. U.S. Pat. 1,494,613. *J. Soc. Chem. Ind.* **43**, B 626. *Chem. Abstr.* **18**, 2239.

FUEL COMPOSITION FOR INTERNAL-COMBUSTION ENGINES.—G. H. Taber and H. Essex. U.S. Pat. 1,495,501. *J. Soc. Chem. Ind.* **43**, B 626. *Chem. Abstr.* **18**, 2239.

MOTOR FUEL.—W. G. Dunning. U.S. Pat. 1,495,005. *J. Soc. Chem. Ind.* **43**, B 626. *Chem. Abstr.* **18**, 2239.

LIQUID FUEL.—F. W. Ferrer, Assr. to M. M. Power. U.S. Pat. 1,496,260. *J. Soc. Chem. Ind.* **43**, B 626. *Chem. Abstr.* **18**, 2421.

LIQUID FUEL MIXTURE.—J. Dolfen. U.S. Pat. 1,493,874. *Chem. Abstr.* **18**, 2070.

LIQUID FUEL.—D. Annaratone. Brit. Pat. 217,873. *Chem. Age* **11**, 197.

FUEL FOR INTERNAL-COMBUSTION ENGINES.—M. Frig and Bayerische Motoren Werke Akt. Ges. Brit. Pat. 212,115. *Chem. Abstr.* **18**, 2239.

COMPOSITION FOR REMOVING INCRUSTATIONS FROM INTERNAL COMBUSTION-ENGINES.—H. L. Finnegan. U.S. Pat. 1,494,678. *Chem. Abstr.* **18**, 2239.

COMBUSTION CATALYST IN INTERNAL-COMBUSTION ENGINES.—E. Sokal. Brit. Pat. 211,936. *Chem. Abstr.* **18**, 2239.

LIQUID FUEL.—G. Henneberg and M. Charpentier. Brit. Pat. 213,526. *Chem. Abstr.* **18**, 2421.

PREPARATION OF HOMOGENEOUS MIXTURES OF ORGANIC LIQUIDS (MOTOR FUELS).—W. Schrauth. Ger. Pat. 393,627. *J. Soc. Chem. Ind.* **43**, B 704.

LIQUID FUEL MIXTURE.—J. F. P. La Riboisière. Brit. Pat. 213,948. *Chem. Abstr.* **18**, 2598. *Oil Engineering and Finance* **5**, 420.

HYDROCARBON FUEL CONTAINING WATER.—C. B. Belknop. U.S. Pat. 1,498,340. *Chem. Abstr.* **18**, 2598.

DEVICE FOR SUPPLYING AN INTERNAL-COMBUSTION ENGINE WITH A CATALYSED MIXTURE OF WATER VAPOUR AND HYDROCARBONS WITH AIR.—C. E. Laurent. Brit. Pat. 197,647. *J. Soc. Chem. Ind.* **43**, B 779.

FUEL FOR USE IN INTERNAL-COMBUSTION ENGINES.—H. R. Ricardo. U.S. Pat. 1,504,837.

10. LUBRICATION AND LUBRICANTS.

AIR COMPRESSOR CYLINDER LUBRICATION.—*Lubrication* **10**, 25.

THE DEVELOPMENT OF AUTOMATIC LUBRICATION.—*Lubrication* **10**, 37.

LUBRICATION IN THE STEEL INDUSTRY.—*Lubrication* **10**, 49.

REMEDIES FOR CRANK CASE DILUTION TAKEN UP BY AUTOMOTIVE ENGINEERS.—(Soc. Auto. Engrs. Discussion.) *Nat. Petr. News* **16**, (28), 17.

LUBRICATION OF REFRIGERATION COMPRESSORS.—A. F. Brewer. *Power* **59**, 524. *Chem. Abstr.* **18**, 2245.

MAINTAINING QUALITY OF STEAM TURBINE OILS IN SERVICE.—H. Bromley. *Power* **59**, 125. *Chem. Abstr.* **18**, 2245.

THE ECONOMIC LUBRICATION OF THE IMPORTANT MACHINERY IN THE (SUGAR) REFINERY.—A. Lukás. *Listy Cukrovar* **42**, 262. *Chem. Abstr.* **18**, 2425.

SOME BEARING INVESTIGATIONS (LUBRICATING OILS).—E. G. Gilson. *Gen. Elec. Rev.* **27**, 318. *Chem. Abstr.* **18**, 2599.

DOES THE zn/p FUNCTION FIT THE FACTS ?—A. E. Becker. *Ind. Eng. Chem.* **16**, 856. *Chem. Abstr.* **18**, 2803.

TECHNIC OF LUBRICATION.—J. Lévy. *Tech. Moderne* **16**, 453. *Chem. Abstr.* **18**, 2803.

SPECIFIC HEATS OF LUBRICATING OILS.—E. H. Leslie and J. C. Geniesse. *Ind. and Eng. Chem.* **16**, 582. *Chem. Abstr.* **18**, 2804.

LUBRICATION VALUE OF OILS IS AFFECTED BY PROPERTIES OTHER THAN VISCOSITY.—P. M. Heldt. *Auto. Ind.* **49**, 842.

DILUTION OF CRANK CASE OIL IS SERIOUS FACTOR EVEN IN SUMMER.—A. L. Clayden. *Auto. Ind.* **49**, 415.

PATENTS.

LUBRICANTS.—A. G. Marshall. Brit. Pat. 211,978. *Chem. Abstr.* **18**, 2246.

LUBRICANT FOR BRAKE BANDS.—R. H. Hutchinson. U.S. Pat. 1,500,193. *Chem. Abstr.* **18**, 2805.

11. FUEL OIL.

SLOW GELATION IN PRESSURE-STILL TAR.—S. E. Sheppard and L. W. Eberlin. *Ind. and Eng. Chem.* **16**, 832. *J. Soc. Chem. Ind.* **43**, B 777.

REMODELLING LARGE HEATING SYSTEMS TO USE HEAVIER OILS FOR BURNING.—*Oil and Gas J.* **23**, (6-A), 76.

OIL AND COAL COMPARED AS FUEL IN PURCHASING AGENT'S VIEWPOINT.—T. Harris. *Oil and Gas J.* **23**, (7-A), 96.

FUEL OIL OR COAL FOR STEAM GENERATION.—F. H. Daniels. *Power* **59**, 463. *Chem. Abstr.* **18**, 2235.

RELATIVE VALUES OF COAL AND OIL AS FUEL.—C. H. Butz. Forging and Heat-Treating **8**, 262. *J. Inst. Metals* **30**, 692. *Chem. Abstr.* **18**, 2235.

LIQUID FUELS AND THEIR IMPORTANCE TO AUSTRALIA.—G. H. Knibbs. *Chem. Eng. Mining Rev.* **16**, 301.

SAVINGS IN INDUSTRIAL PLANTS BY BURNING OIL.—G. E. Lawrence. *Oil News (U.S.A.)* **12**, (7), 42. *Chem. Abstr.* **18**, 2797.

ATOMISING AGENTS FOR FUEL OIL IN REGENERATIVE FURNACES.—G. H. Heine. *Fuels and Furnaces* **2**, 650. *Chem. Abstr.* **18**, 2797.

WILL PULVERISED COAL BE SUBSTITUTED FOR FUEL OIL IN SMELTING OPERATIONS?—T. H. O'Brien. *Coal Age* **23**, (25), 1013. *Chem. Abstr.* **18**, 2417.

WHAT FUEL-OIL SPECIFICATIONS MEAN.—S. O. Andros. *Fuels and Furnaces* **2**, 545.

THE HEATING OF HOUSES WITH OIL.—C. H. Chambers. *Bull. Amer. Petr. Inst.* **4**, 77.

OIL-FIRED SCOTCH BOILER GIVES 85 PER CENT. EFFICIENCY.—C. J. Jefferson. *Marine Eng.* **28**, 615.

PATENT.

LIQUID FUEL MIXTURE.—R. A. Butler. Brit. Pat. 213,628. *Chem. Abstr.* **18**, 2421. *J. Soc. Chem. Ind.* **43**, B 503.

12. DIESEL OIL AND ENGINES.

DIESEL ENGINE.—G. J. Wells and A. J. Wallis-Taylor. D. van Nostrand Co., New York.

ENGINEER SAYS DIESEL ENGINES SHOULD BURN HEAVY FUEL OIL.—R. Hildebrand. *Oil and Gas J.* **23**, (8-A), 92.

TESTS SHOW HEAVY FUEL MAY BE USED IN PROPERLY DESIGNED DIESEL.—R. Hildebrand. *Nat. Petr. News* **16**, (28), 114.

FUEL AND MOTOR OILS.—D. Aufhäuser. Z. Ver. deut. Ing. **66**, 419. *Chem. Abstr.* **18**, 2797.

DIESEL AND OIL ENGINEERING HANDBOOK. (2nd edit.)—J. Rosbloom. Technical Publishing Co., Los Angeles, California.

TECHNIQUE ET PRATIQUE DES MOTEURS À HUILE LOURDE À INJECTION DIRECTE.—Y. Le Gallou. Dunod, Paris.

FUELS AND THEIR COMBUSTION IN THE DIESEL ENGINE.—Alt. Verein Deutscher Ingenieure. *Motorship* **8**, 551.

PROGRESS MADE IN IMPROVEMENT OF DIESEL ENGINE, INCLUDING PROVISIONS FOR BURNING OF HEAVIER FUELS.—Nagel. Verein Deutscher Ingenieure. *Motorship* **8**, 551.

TESTS MADE WITH FUEL INJECTION WITH AND WITHOUT AID OF AIR BLAST.—Newmann. Verein Deutscher Ingenieure. *Motorship* **8**, 551.

INCREASING THE POWER OF 4-CYCLE ENGINES BY INCREASING PISTON PRESSURE BY INDUCTION OF AN INCREASED QUANTITY OF FUEL INTO REGULAR AIR CHARGE OF THE WORKING CYLINDER.—Riehm. Verein Deutscher Ingenieure. *Motorship* **8**, 551.

PATENT.

PREPARATION OF A LIQUID FUEL.—Plauson's Forschungsinstitut G.m.b.H. Ger. Pat. 392,798. *J. Soc. Chem. Ind.* **43**, B 665.

13. PLANT AND MACHINERY.

THE OIL ENGINEER: TUBES, PIPES AND VALVES.—T. Watts-Rockett. *Oil News* **16**, 10, 77, 97, 121, 151, 187, 234, 265, 291, 317, 347.

THE MODERN THEORY AND PRACTICE OF PUMPING.—N. Swindon. Ernest Benn, Ltd., London.

THE "MOORE-BURMAH" OIL COOLER.—*Oil Engineering and Finance* **5**, 464. *Chem. and Met. Eng.* **31**, 234.

NEW VALVE FOR THE HUGHES LUBRICATOR.—*Petr. Times* **12**, 234.

NEW OIL SEPARATOR BARGE IS DESIGNED TO STOP POLLUTION.—L. M. Fanning. *Oil and Gas J.* **23**, (8-A), 128.

TUBE SECTION TREATING PLANT CUTS OIL RECOVERY COSTS 6 CENTS A BARREL.—P. Wagner. *Nat. Petr. News* **16**, (30), 71.

PORTABLE REFINERY MOUNTED ON RAILROAD CARS.—J. C. Winslow. *Gas Age-Record* **53**, 723. *Chem. Abstr.* **18**, 2242.

METERING VISCOUS LIQUIDS.—E. S. Smith. *Chem. and Met. Eng.* **29**, 20. *Chem. Abstr.* **18**, 2268.

SMALL TRACTORS MAKE EFFICIENT POWER UNIT FOR GENERAL PLANT UTILITY WORK.—*Ref. and Nat. Gas. Mfr.* **3**, (8), 18.

COLLOID MILL AID TO PROCESS PLANTS.—W. A. McLean. *Ref. and Nat. Gas. Mfr.* **3**, (8), 29.

CAST-IRON STORAGE TANKS.—*Chem. and Met. Eng.* **31**, 312.

IMPROVED PROCESS FOR THE RECTIFICATION OF LIQUIDS.—F. Burk. *Chem. Zeit.* **43**, 359. *Chem. Abstr.* **18**, 2568.

THE PIRBRIGHT OIL SEPARATOR.—*Petr. Times* **12**, 450.

AN OIL-WELL MEASURING DEVICE.—*Petr. Times* **12**, 504.

PURIFICATION DES LIQUIDES PAR L'ACTION SIMULTANÉE DE LA FORCE CENTRIFUGE ET DU CHAMP ÉLECTRIQUE.—A. Marx and J. Rozières. *Chim. et Ind.* **10**, 218.

EXPLAINS THEORY GOVERNING CARBURETTOR WITH INTAKE THROTTLE.—P. S. Tice. *Auto. Ind.* **49**, 1099.

HOT OIL PUMP FOR REFINERS.—*Oil Trade J.* **15**, (7), 66.

PATENTS.

STILL.—J. L. Major. U.S. Pat. 1,496,899. *Chem. Abstr.* **18**, 2426. *Nat. Petr. News* **16**, (33), 75.

MEANS FOR DEHYDRATING LIQUIDS SUCH AS COAL TAR, CRUDE PETROLEUM AND THE LIKE.—S. W. A. Wikner, Assr. to Newcastle-upon-Tyne and Gateshead Gas Co. U.S. Pat. 1,495,543. *Nat. Petr. News* **16**, (2), 90. *Chem. Abstr.* **18**, 2240.

FRACTIONAL CONDENSER.—K. Fuchs. U.S. Pat. 1,495,972. *J. Soc. Chem. Ind.* **43**, B 622. *Nat. Petr. News* **16**, (29), 89.

PROCESS OF BURNING FUEL OIL AND APPARATUS THEREFOR.—R. W. Wiederwax. Brit. Pat. 216,325. *J. Soc. Chem. Ind.* **43**, B 626.

APPARATUS FOR BOILING (MINERAL) OIL (TO DEHYDRATE IT).—A. L. G. Dehne. Ger. Pat. 385,760. *J. Soc. Chem. Ind.* **43**, B 626.

CENTRIFUGAL SEPARATION OF OIL AND WATER OR OTHER LIQUIDS.—H. O. Lindgren. U.S. Pat. 1,493,206. *Chem. Abstr.* **18**, 2051.

METHOD OF RECOVERING VOLATILE FLUIDS FROM LIQUIDS CONTAINING THE SAME.—J. C. Bertsch, Assgr. to the Bertsch Process Co. U.S. Pat. 1,498,069. *Ref. and Nat. Gas. Mfr.* **3**, (7), 41. *Chem. Abstr.* **18**, 2600.

APPARATUS FOR INDICATING LIQUID LEVELS IN HIGH PRESSURE STILLS OR OTHER VESSELS.—Internationale Bergen-Cie voor Olie-en Kolen-Chemie and S. Löffler. Brit. Pat. 216,959. *J. Soc. Chem. Ind.* **43**, B 657.

APPARATUS FOR THE TREATMENT OF OIL REFINERY GASES.—F. A. Willard. U.S. Pat. 1,497,128. *J. Soc. Chem. Ind.* **43**, B 665.

FILLING FOR DISTILLING COLUMNS OR OTHER APPARATUS FOR TREATMENT OF GASES AND LIQUIDS ONE WITH THE OTHER.—J. H. Bregeat. U.S. Pat. 1,494,989. *Chem. Abstr.* **18**, 2091.

APPARATUS FOR SEPARATING OIL AND WATER.—G. P. Haynes. U.S. Pat. 1,494,906. *Chem. Abstr.* **18**, 2091.

RECOVERING OIL FROM OIL SAND.—A. Streppel. U.S. Pat. 1,497,607. *Chem. Abstr.* **18**, 2426.

OIL-PURIFYING DEVICE.—S. L. Marsh. U.S. Pat. 1,496,160. *Chem. Abstr.* **18**, 2426.

APPARATUS FOR SEPARATING WATER AND OIL FROM OIL WELLS.—W. M. Marker and W. R. Allen. U.S. Pat. 1,496,090. *Chem. Abstr.* **18**, 2426.

MECHANICAL SEPARATION OF LIQUIDS AND SOLIDS OF DIFFERENT DENSITIES.—L. Linden. Brit. Pat. 217,854. *J. Soc. Chem. Ind.* **43**, B 698.

SEPARATING LIQUIDS (*e.g.*, OIL FROM WATER) AND MEANS THEREFOR.—F. Pink. Brit. Pat. 218,462.

PROCESS OF DISTILLING OIL.—J. J. Allinson, Assgnr. to Doherty Research Co., New York. U.S. Pat. 1,500,040–1. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39. *J. Soc. Chem. Ind.* **43**, B 779. *Chem. Abstr.* **18**, 2804.

PROCESS OF PURIFYING MINERAL OIL.—E. Petty, Assgr. to The De Laval Separator Co. U.S. Pat. 1,500,202. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39.

APPARATUS FOR COOLING FULLER'S EARTH OR OTHER COMMINUTED SOLID MATERIAL.—J. O. Jensen. U.S. Pat. 1,498,630. *Chem. Abstr.* **18**, 2446.

PLASTIC COMPOSITION.—D. D. Greene. U.S. Pat. 1,497,782. *Chem. Abstr.* **18**, 2601.

CENTRIFUGAL SEPARATORS (FOR LIQUIDS).—Aktiebolaget Separator. Brit. Pat. 202,616. *J. Soc. Chem. Ind.* **43**, B 736.

SEPARATORS EMPLOYED FOR THE SEPARATION OF LIQUIDS OF DIFFERENT DENSITY.—W. H. Bateman. Brit. Pat. 218,742. *J. Soc. Chem. Ind.* **43**, B 736.

CENTRIFUGAL APPARATUS FOR EMULSIFICATION OF LIQUIDS WHICH WILL NOT MIX.—N. Bendixon. Brit. Pat. 219,038.

CENTRIFUGAL FOR MAKING FINELY DIVIDED PITCH.—R. Mackay. The Barrett Co. U.S. Pat. 1,503,960. *Chem. and Met. Eng.* **31**, 392.

CRYSTALLISING AND SWEATING PARAFFIN.—H. L. Allan, J. Moore and The Burmah Oil Co., Ltd. U.S. Pat. 1,504,923. *Chem. and Met. Eng.* **31**, 393.

APPARATUS FOR THE TREATMENT OF FLUIDS.—E. Shaw. U.S. Pat. 1,499,481. *J. Soc. Chem. Ind.* **43**, B 774.

HEAT EXCHANGERS.—C A. Brown. Brit. Pat. 219,788.

FRACTIONAL DISTILLATION OF PETROLEUM AND SIMILAR HYDROCARBONS.—Brünn-Königsfelder Maschinen-Fabr. der Maschinen u. Waggonbau-Fabr. A. G. vorm. H. Schmid and K. Fuchs. Brit. Pat. 196,624. *J. Soc. Chem. Ind.* **43**, B 779.

LIQUID FUEL BURNERS.—H. Wilson and Co., Ltd. and H. Foden. Brit. Pat. 219,790.

CONTROLLING SUPPLY OF "ANTI-KNOCK" COMPOUNDS TO INTERNAL-COMBUSTION ENGINES AS NEEDED.—T. Midgley. U.S. Pat. 1,501,568. *Chem. Abstr.* **18**, 2801.

APPARATUS FOR SEPARATING OIL FROM GAS AT WELLS.—E. C. Weisgerber. U.S. Pat. 1,499,710.

TREATMENT OF OIL SANDS.—L. S. Clark. Can. Pat. 241,237. *Chem. Abstr.* **18**, 2805.

CIRCULATORY PROCESS AND APPARATUS FOR CATALYTICALLY TREATING MATERIALS. (PREPARATION OF LAMPBLACK.)—E. Hopkinson. U.S. Pat. 1,497,751. *J. Soc. Chem. Ind.* **43**, B 720.

14. TESTING, ANALYSIS AND APPARATUS.

FURTHER CONTRIBUTION TO THE INVESTIGATION OF BENZOL, BENZINE AND TURPENTINE OIL. J. Pritzker and R. Jungkunz. *Chem. Zeit.* **48**, 455.

DETERMINATION OF SLUDGE VALUE (OF TURBINE AND TRANSFORMER OILS).—F. Schwarz and J. Marcusson. *Petroleum* **20**, 776. *J. Soc. Chem. Ind.* **43**, B 586.

SODIUM PLUMBITE OR "DOCTOR" TEST OF GASOLINES.—B. T. Brooks. *Ind. and Eng. Chem.* **16**, 588. *J. Soc. Chem. Ind.* **43**, B 624. *Chem Abstr.* **18**, 2803.

THE FISCHER RETORT FOR DETERMINING THE AMOUNT OF PRIMARY TAR IN SHALES, LIGNITES AND BITUMINOUS COALS.—P. Petroff. *Mat. grasses* **16**, 6754. *Chem. Abstr.* **18**, 2070.

A CALORIMETER FOR MEASURING SPECIFIC HEATS AND HEATS OF VAPORISATION OF LIQUIDS.—F. G. Keyes and J. A. Beattie. *J. Amer. Chem. Soc.* **46**, 1733.

U.S. GOVERNMENT SPECIFICATION FOR LUBRICANTS AND LIQUID FUELS AND METHODS FOR TESTING.—*U.S. Bureau Mines Tech. Paper* 323A. *J. Soc. Chem. Ind.* **43**, B 660.

DETERMINATION OF ANHYDROUS SOAP IN LUBRICATING GREASE.—B. Joachim. *Ind. and Eng. Chem.* **16**, 725. *J. Soc. Chem. Ind.* **43**, B 661. *Chem. Abstr.* **18**, 2425.

DETERMINATION OF LUBRICANT FRICTION.—R. Vieweg. *Petroleum* **20**, 899. *J. Soc. Chem. Ind.* **43**, B 661.

CONDENSER FOR DISTILLING OILS OF WIDE BOILING RANGE.—H. N. Calderwood. *Ind. and Eng. Chem.* **16**, 576. *J. Soc. Chem. Ind.* **43**, B 656. *Chem. Abstr.* **18**, 2620.

APPARATUS FOR FRACTIONAL DISTILLATION IN A VACUUM.—K. Würth. *Z. angew. Chem.* **37**, 226. *Chem. Abstr.* **18**, 2089.

CAPILLARY TUBE VISCOMETERS. II.—G. Barr. *J. Scient. Instruments* **1**, 111. *Chem. Abstr.* **18**, 2090.

ESTIMATION OF PARAFFIN OIL IN PHARMACEUTICAL PREPARATIONS.—J. Weichherz and Z. Klinger. *Chem. Zeit.* **48**, 20. *Chem. Abstr.* **18**, 2222.

CALORIFIC VALUE OF LIQUID FUELS.—G. Morpurgo. *Mitt. staatl. techn. Versuchsamts* **10**, 97. *Chem. Abstr.* **18**, 2797.

DETERMINATION OF NAPHTHENIC ACIDS.—B. Tütünnikoff. *Seifensieder Zeit.* **51**, 198. *Chem. Abstr.* **18**, 2258.

WHAT IS THE SIMPLEST WAY OF CALCULATING PYCNOMETER DENSITY DETERMINATIONS? R. Saar. *Chem. Zeit.* **48**, 285. *Chem. Abstr.* **18**, 2271.

IDENTIFICATION OF BENZENE IN MIXTURES WITH OTHER HYDROCARBONS.—O. Weber. *11th Rept. Fuel Tech. Inst. Czech. Polytech. Highschool, Prague* 1922–3, 99. *Chem. Abstr.* **18**, 2302.

IDENTIFICATION OF SMALL QUANTITIES OF TOLUENE BY NITRATION.—J. Hamackova. *11th Rept. Fuel Tech. Czech. Polytech. Highschool, Prague*, 1922–3, 100. *Chem. Abstr.* **18**, 2302.

USE OF AIR BATH IN DETERMINATION OF SOLID RESIDUE OF ROAD OILS AT 100 PENETRATION.—H. F. Clemmer and H. C. Helmle. *Proc. Am. Soc. Testing Materials* **23**, II, 351.

DETERMINATION OF THE TAR NUMBER.—F. Schwarz and J. Marcusson. *Petroleum* **20**, 776. *Chem. Abstr.* **18**, 2423.

FINDING GASOLINE CONTENT OF CRUDE.—S. E. Campbell. *Ref. and Nat. Gas. Mfr.* **3**, (16), 15. *Chem. Abstr.* **16**, 2423.

EMERSON FUEL CALORIMETERS.—Emerson Apparatus Co., Melrose, Mass.

APPARATUS FOR FRACTIONAL DISTILLATION UNDER REDUCED PRESSURE, BASED ON THE USE OF TWO WATER-JET PUMPS.—E. André. *Bull. soc. chim.* **35**, 647. *Chem. Abstr.* **18**, 2444.

CALCULATION OF THE CALORIFIC VALUE.—O. Niezoldi. *Chem. Zeit.* **48**, 135 *Chem. Abstr.* **18**, 2445.

CALORIMETRIC BOMBS.—A. Mennucci. *Rev. facultad. cienc. quim.* **2**, 25. *Chem. Abstr.* **18**, 2456.

COLOUR ESTIMATION AND CONTROL.—S. Jordan. *Chem. Age (New York)* **32**, 219. *Chem. Abstr.* **18**, 2460.

DETERMINATION OF THE IGNITION UNDER PRESSURE.—J. Tauss and F. Schulte. *Z. Ver. deut. Ind.* **68**, 574. *Chem. Abstr.* **18**, 2594.

VISCOSITY CHART FOR MINERAL OILS AND HOW TO USE IT.—R. Cross. *Oil and Gas News* **14**, (6), 18. *Chem. Abstr.* **18**, 2599.

PROPOSES FURTHER STUDY OF METHODS OF TAKING VAPOUR TENSION. *Nat. Petr. News* **16**, (33), 77.

Sludging Test for Transformer Oils.—W. H. Nuttall. *World Power* **2**, 92. *J. Soc. Chem. Ind.* **42**, B 739.

Combustion of Petroleum Hydrocarbons.—C. F. Mabery. *Ind. and Eng. Chem.* **16**, 911.

Small Scale Fractional Distillation.—L. Crismer. *Bull. soc. chim. Belg.* **23**, 254. *Chem. Abstr.* **18**, 2619.

New Method of Determination of Volatile Products in Mineral Oils.—M. V. Borodulin. *J. Russ. Phys.-Chem. Soc.* **54**, 195. *Chem. Abstr.* **18**, 2802.

A Reliable Apparatus for the Rapid Analysis and Regulation of Highly Viscous Substances.—G. F. Dierfield. *Chem. News* **127**, 228.

Patents.

Colorimeter.—T. D. Simpson and A. C. Woodman. U.S. Pat. 1,495,763. *Chem. Abstr.* **18**, 2246.

Refractometers (with Temperature-Compensating Device).—Optische Anstalt C. P. Goerz A.-G. Brit. Pat. 213,286.

15. Cracking and Hydrogenation.

The Hydrogenation of Coal and Oils.—A. Kling. *Chim. et Ind.* **11**, 1067. *Chem. Trade J.* **75**, 127. *J. Soc. Chem. Ind.* **43**, B 701.

Catalytic Hydrogenation and its Applications.—J. v. Braun. *Z. für angew. Chem.* **37**, 349.

Catalytic Decomposition of Hexahydro-aromatic and Saturated Aliphatic Hydrocarbons. A Contribution to the Study of the Cracking of Petroleum.—V. Grignard and R. Stratford. *Compt. rend.* **178**, 2149. *J. Soc. Chem. Ind.* **43**, B 661.

Modern Cracking Process Described.—H. Tropsch. *Oil and Gas J.* **23**, (7-A), 108.

First Knox Cyclic Cracking Plant.—J. M. Fanning. *Oil and Gas J.* **23**, (8-A), 104.

Making the Refinery Show a Profit by Reducing Operation Costs. *Nat. Petr. News* **16**, (27), 57.

Cracked Gasoline and the Patent Situation.—H. O. Chute. *Ind. and Eng. Chem. News* **2**, (15), 3.

Pyrogenetic Formation of Aromatic Hydrocarbons from Paraffin Wax.—B. Kabelac. *11th Rept. Fuel Tech. Inst. Czech. Polytech. High-school, Prague*, 1922–3, 86. *Chem. Abstr.* **18**, 2242.

The Cracking Process of Burton.—H. I. Waterman and H. H. W. Reus. *Rev. trav. chim.* **43**, 87. *Chem. Abstr.* **18**, 2242.

Thermal Relations in Cracking Petroleum.—R. Cross. *Oil Age* **21**, (5), 11. *Chem. Abstr.* **18**, 2243.

INSTALLS TWO TUBE AND TANK CRACKING UNITS.—J. C. Chatfield. *Nat. Petr. News* **16**, (21), 54. *Chem. Abstr.* **18**, 2243.

VISCOSITIES AND COLD TESTS OF FUEL OILS.—H. Moore. *Oil Eng. and Finance* **5**, 358. *Chem. Abstr.* **18**, 2423.

CRACKING SYSTEMS AFFECT CRUDE-OIL SITUATION.—J. B. Waldo. *Oil News* (U.S.A.) **12**, (6), 21. *Chem. Abstr.* **18**, 2424.

THE TREATMENT OF MEXICAN ASPHALT AND PARAFFIN WAX BY HEATING UNDER PRESSURE WITH SODIUM FORMATE AND WITH CARBON MONOXIDE AND WATER RESPECTIVELY.—H. I. Waterman and F. Kortlandt. *Rev. trav. chim.* **43**, 249. *Chem. Abstr.* **18**, 2425.

PETROL AND ITS DERIVATIVES. STUDY OF CRACKING. PART I.—H. Gault. *Matières grasses* **17**, 6870.

THE CRACKING OF HEAVY OILS.—Brennstoff-Chemie. *Chem. and Ind.* **43**, 878.

PYROGENIC DISSOCIATION OF HEXADECANE.—H. Gault and F. A. Hessel. *Compt. rend.* **179**, 171. *J. Soc. Chem. Ind.* **43**, B 700.

FLEXIBILITY GAINED IN INVINCIBLE CRACKING PLANT.—*Ref. and Nat. Gas. Mfr.* **3**, (8), 21.

ORMONT CRACKING PROCESS DESCRIBED.—*Petr. Age* **14**, (4), 48.

MODERN CRACKING PROCESSES.—H. Tropsch. *Brennstoff Chem.* **5**, 97. *Chem. Abstr.* **18**, 2599.

CLAIMS ADVANCED FOR LINTON PROCESS.—C. E. Kern. *Oil and Gas J.* **23**, (11-A), 92.

THE PYROGENOUS DISSOCIATION OF HEXADECANE.—H. Gault and Y. Altchidjian. *Ann. Chim.* **22**, 209.

MOTOR FUEL FROM HEAVY OIL BY HYDROGENATION.—H. G. Shatwell. *Canad. Mining J.* **44**, 871.

DOHERTY HAS NEW REFINING PROCESS.—*Oildom Daily* (Feb. 1), 1.

PATENTS.

APPARATUS FOR REFINING (HYDROCARBON) OILS.—W. J. Reilly. U.S. Pat. 1,494,375. *J. Soc. Chem. Ind.* **43**, B 626.

PROCESS OF TREATING HYDROCARBONS.—J. H. Riddick. U.S. Pat. 1,496,742. *J. Soc. Chem. Ind.* **43**, B 626.

CRACKING HYDROCARBONS.—A. A. F. M. Seigel. Brit. Pat. 216,150. *Chem. Age* **11**, 123.

CRACKING AND HYDROGENATING HYDROCARBON OILS.—Internationale Bergin-Compagnie voor Olie en Kolen-Chemie. Brit. Pat. 216,882. *Chem. Abstr.* **11**, 124.

HYDROGENATING GAS FOR DECOMPOSING HYDROCARBONS OR COAL.—F. Bergius. Ger. Pat. 394,497. *J. Soc. Chem. Ind* **43**, B 664.

Treatment of Hydrocarbon Oil Vapours and Apparatus Therefor.—F. Lamplough. Brit. Pat. 216,922. *J. Soc. Chem. Ind.* **43**, B 665. *Chem. Age* **11**, 44.

Electrically Heated Oil-cracking Apparatus.—C. M. Page, assgd. to G. Fabyan. U.S. Pat. 1,494,125. *Nat. Petr. News* **16**, (29), 89. *J. Soc. Chem. Ind.* **43**, B 550. *Ref. and Nat. Gas. Mfr.* **3**, (6), 39.

Process of Treating Petroleum and Petroleum Derivatives.—H. B. Setzler, assgd. to The National Refining Co. U.S. Pat. 1,494,191. *Nat. Petr. News* **16**, (29), 89. *J. Soc. Chem. Ind.* **43**, B 550. *Ref. and Nat. Gas. Mfr.* **3**, (6), 39. *Chem. Abstr.* **18**, 2245.

Apparatus for Refining Oil.—W. J. Reilly. U.S. Pat. 1,494,375. *Nat. Petr. News* **16**, (29), 89. *Chem. Abstr.* **18**, 2245.

Cracking and Hydrogenating Hydrocarbon Oils. G. P. Lewis. Brit. Pat. 213,295. *Chem. Abstr.* **18**, 2426. *J. Soc. Chem. Ind.* **43**, B 460. *Chem. Age* **10**, 469.

Purifying and Hydrogenating Hydrocarbons.—M. Hofsas and Internationale Bergin Compagnie voor Olie en Kolen-Chemie. Brit. Pat. 213,661. *Chem. Abstr.* **18**, 2426. *J. Soc. Chem. Ind.* **43**, B 503. *Chem. Age* **10**, 495. *Oil Engineering and Finance* **5**, 420.

Cracking of Oils.—V. L. Oil Processes, Ltd., O. D. Lucas, and E. L. Lomax. Brit. Pat. 219,403–4. *Chem. Age* **11**, 221. *J. Soc. Chem. Ind.* **43**, B 779.

Process of Distilling Oils.—A. McD. McAfee, Assgr. to Gulf Refining Co. U.S. Pat. 1,501,104. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39.

Treatment of Liquid Hydrocarbons.—S. J. M. Auld, A. E. Dunstan and P. H. Herring. Brit. Pat. 220,664. *Chem. Age* **11**, 329.

Cracking of Hydrocarbon Oils and Treatment of Solid Carbonaceous Substances.—T. M. Davidson and G. P. Lewis. Brit. Pat. 220,732. *Chem. Age* **11**, 330.

Apparatus for Distilling and Cracking Petroleum Oil.—E. E. Reilly and R. M. McLain. U.S. Pat. 1,501,371. *Chem. Abstr.* **18**, 2804.

Distillation (of Oils) with Aluminium Chloride.—A. M. McAfee, Assr. to Gulf Refining Co. U.S. Pat. 1,501,014. *J. Soc. Chem. Ind.* **43**, B 779. *Chem. Abstr.* **18**, 2804.

16. Insulating Oils.

Action of Soaps on Transformer Oils.—H. von der Heyden and K. Typke. *Petroleum* **20**, 857. *J. Soc. Chem. Ind.* **43**, B 624.

Heating Transformer Oils with Various Salts.—H. von der Heyden and K. Typke. *Petroleum* **20**, 953. *J. Soc. Chem. Ind.* **43**, B 702.

Heating of Transformer Oils with Metals in Absence of Air.—H. von der Heyden and K. Typke. *Petroleum* **20**, 1128. *J. Soc. Chem. Ind.* **43**, B 739.

Patents.

Preserving Mineral Oils.—British Thomson-Houston Co., Ltd. Brit. Pat. 212,928. *Chem. Abstr.* **18**, 2245. *Oil Engineering and Finance* **3**, 341.

Inert Gas on Transformer Tanks.—Ateliers de Constructions Electriques de Charleroi soc. anon. Brit. Pat. 213,907. *Chem. Abstr.* **18**, 2601.

17. Shale and Shale Oils.

Oil and Cement in Tasmania.—*Melbourne Age. Oil News* **16**, 130.

Studies of Ten Typical Oil Shales.—*U.S. Bureau Mines Repts. Investigations* 2603. *Oil Weekly* **34**, (1), 74. *Oil Trade J.* **15**, (7), 72.

Japan's Problem of Oil Supplies.—*Oil News* **16**, 176.

The Development of a South African Oil Industry.—*Petr. Times* **12**, 266.

Oil Shale in the United States.—V. C. Alderson. *Petr. Times* **12**, 274.

Colorado Mining Engineer says Shale Oil Producible at $1·50 bl. —*Oil and Gas J.* **23**, (6-A), 82.

Constitution of Kerogen.—J. W. McKinney. *J. Amer. Chem. Soc.* **40**, 968. *Chem. Abstr.* **18**, 2244.

Heat Treatment of Oil Shale.—V. Z. Caracristi. *Combustion* **10**, 336. *Chem. Abstr.* **18**, 2244.

Oil Shales of Brazil.—D. T. Day. *Oil Engineering and Finance* **5**, 232. *Chem. Abstr.* **18**, 2244.

Oil Shale in the U.S.—V. C. Alderson. *Railroad Red Book* **41**, 533.

Oil Shale in Foreign Countries.—V. C. Alderson. *Railroad Red Book* **41**, 597.

The Trumble Oil-shale Cycle Distillation Plant.—V. C. Alderson. *Petr. Times* **12**, 327.

Relative to Oil Shale.—D. T. Day. *Oil Engineering and Finance* **5**, 517.

Esthonian Shale.—U.S. Dept. Commerce Circ., Ill. *Oil Engineering and Finance* **5**, 517.

The Shale Industry of Tasmania.—*U.S. Commerce Rept. Oil Engineering and Finance* **5**, 519.

The Distillation of Oil Shale.—*U.S. Bureau Mines Rept. Petr. Times* **12**, 504.

Deposits of Bituminous Schists in France.—*Rass. min. met. chim.* **60**, 60. *Chem. Abstr.* **18**, 2671.

Oil Shale in Esthonia and its Use.—O. Cyrén. *Svensk Kem. Tids.* **30**, 54. *Chem. Abstr.* **18**, 2803.

Patents.

Isolation of Bituminous Substances from Oil Shale.—Holzverkohlungs-Ind. A.G. Ger. Pat. 389,896. *J. Soc. Chem. Ind.* **43**, B589.

Desulphurisation of Shale Oils or Tars.—F. Escherich, B. Pretzsch and O. Danguillier. Ger. Pat. 392,206. *J. Soc. Chem. Ind.* **43**, B589.

Apparatus for Distilling Coal, Oil-shale and the like.—T. W. S. Hutchins. U.S. Pat. 1,498,917. *Ref. and Nat. Gas. Mfr.* **3**, (7), 41. *Nat. Petr. News* **16**, (33), 75.

Destructive Distillation.—E. Hinselmann. Brit. Pat. 217,174. *Chem. Age* **11**, 173.

Distilling Solid Fuel.—C. B. Wisner. Brit. Pat. 217,554. *Chem. Abstr.* **18**, 174.

Vapour Extractor (for Distillation of Fuel).—G. A. Bronder, Assr. to T. Costigan. U.S. Pat. 1,496,293. *J. Soc. Chem. Ind.* **43**, B664.

Winning Ammonia (from Bituminous Shale).—A. S. Cooper. U.S. Pat. 1,494,735. *J. Soc. Chem. Ind.* **43**, B665. *Chem. Abstr.* **18**, 2246.

Treatment of Hydrocarbon Oil Vapours and Apparatus Therefor.—F. Lamplough. Brit. Pat. 216,922. *J. Soc. Chem. Ind.* **43**, B665, *Chem. Age* **11**, 44.

Oil-shale Retort.—J. B. Jenson. U.S. Pat. 1,493,880. *Nat. Petr. News* **16**, (29), 90. *J. Soc. Chem. Ind.* **43**, B550. *Ref. and Nat. Gas. Mfr.* **3**, (6), 39.

Distilling Shale.—T. R. Starkey. Brit. Pat. 212,053. *Chem. Abstr.* **18**. 2245.

Distilling Oil Shale.—D. K. Fairweather. Brit. Pat. 212,770. *Chem. Abstr.* **18**, 2245. *Chem. Age* **10**, 416. *Petr. Times* **11**, 619. *J. Soc. Chem. Ind.* **43**, B410. *Oil Engineering and Finance* **3**, 341.

Distilling Oil Shale.—A. Stalli. Brit. Pat. 213,046. *Chem. Abs.* **18**, 2245. *J. Soc. Chem. Ind.* **43**, B459. *Chem. Abstr.* **10**, 445.

Distilling Shale.—W. P. Perry. Brit. Pat. 213,100. *Chem. Abst.* **18**, 2246.

Retort or Still.—F. Lamplough and N. C. T. Harper. U.S. Pat. 1,499,378. *J. Soc. Chem. Ind.* **43**, B698.

Apparatus for the Destructive Distillation of Oil-bearing Materials.—P. T. Alexander, Assr. to A. E. Miller. U.S. Pat. 1,498,528. *J. Soc. Chem. Ind.* **43**, B703. *Nat. Petr. News* **16**, (33), 75.

Shale Retort.—P. L. Bennett. U.S. Pat. 1,501,881. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39.

Shale-distilling Apparatus.—R. M. Catlin, Assgr. to Catlin Shale Products Co. U.S. Pat. 1,503,093. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39. *J. Soc. Chem. Ind.* **43**, B779.

Shale Retort.—D. H. Francis. U.S. Pat. 1,503,234. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39. *J. Soc. Chem. Ind.* **43**, B779.

Oil-shale Extraction Process.—R. W. Jenkins. U.S. Pat. 1,500,323. *J. Soc. Chem. Ind.* **43**, B779. *Chem. Abstr.* **18**, 2805.

18. Lignites and Coals and Their Products.

The Liquefaction of Coal.—F. Bergius. *Z. für angew. Chem.* (June 19). *Petr. Times* **12**, 109.

Coloured Constituents of Montan Wax.—H. Smolkus. *Chem. Zeit.* **48**, 409. *J. Soc. Chem. Ind.* **43**, B624.

Low Temperature Tars and Wood Preservation.—R. P. Soule. *Proc. Am. Wood Preservers' Assoc. Chem. Abstr.* **18**, 2064.

Advances in the Field of Brown Coal Gasification.—Theller. *Feuerungstechnik* **12**, 41. *Chem. Abstr.* **18**, 2069.

The Manufacture of Low Temperature Carbonisation Tar.—G. Paris. *Chaleur et Ind.* **5**, 127. *Chem. Abstr.* **18**, 2070.

Distillation and Gasification of Lignite.—Arnemann. *Z. für angew. Chem.* **37**, 398.

Hydrogenation of Coal.—F. Bergius. *Z. für angew. Chem.* **37**, 400.

Low-Temperature Distillation of Farmville, N.C., Coal.—W. E. Giles and F. C. Vilbrandt. *Ind. and Eng. Chem.* **16**, 779.

The Conversion of Coals into Oils.—F. Fischer. *Petr. Times* **12**, 214.

Practical Coal Carbonisation. Parts I. and II.—F. W. Sperr. *Chem. Age* (*New York*) **32**, 277, 297.

Low Temperature Tar Oils. R. Weissgerber. *Brennstoff Chem.* **5**, 208. *J. Soc. Chem. Ind.* **43**, B666.

Aromatic Hydrocarbons of Low-temperature Tar.—O. Kruber. *Ber.* **57**, 1008. *J. Soc. Chem. Ind.* **43**, B666.

The Rhenish Lignite Industry.—Frezouls. *Rev. ind. minérale* **1924**, 33.

Low-temperature Carbonisation Experiments with South African Coals. III.—P. N. Lategan. *S. Afr. J. Ind.* **7**, 103. *Chem. Abstr.* **18**, 2236.

Thermal Decomposition of Lignite Tar.—B. Kabelac. *11th Rept. Fuel Tech. Inst. Czech. Polytech. Highschool, Prague*, 1922, 89. *Chem. Abstr.* **18**, 2238.

Method of Using the Fischer Schrader Aluminium Retort and Analysis of Distillation Products Obtained Therewith.—E. Nosek. *Brennstoff Chem.* **5**, 17. *Chem. Abstr.* **18**, 2238.

The Behaviour of Montan Wax upon Destructive Distillation.—J. Marcusson. *Z. für angew Chem.* **37**, 35. *Chem. Abstr.* **18**, 2797.

TRANSFORMATIONS CAUSED BY HEATING MIXTURES OF BROWN COAL AND PARAFFIN WAX IN THE PRESENCE OF HYDROGEN OR CARBON MONOXIDE IN CLOSED VESSELS.—H. I. Waterman and F. Kortlandt. *Rec. trav. chim.* **43**, 258. *Chem. Abstr.* **18**, 2417.

SULPHUR DETERMINATION IN BROWN COAL.—F. Bauridel. *Chem. Zeit.* **48**, 122. *Chem. Abstr.* **18**, 2418.

THE FIRST RHENISH BROWN COAL FAIR IN COLOGNE.—Grünewald. *Feuerungstechnik* **12**, 146. *Chem. Abstr.* **18**, 2418.

THE GASIFICATION OF RHENISH BROWN COAL, GAS PRODUCERS AND DISCHARGING EQUIPMENT.—H. Becker. *Braunkohle* **23**, 109. *Chem. Abstr.* **18**, 2419.

LIGNITE CARBONISATION.—W. W. Odell. *U.S. Bureau Mines Repts. Investigations* 2569. *Chem. Age (New York)* **32**, 127. *Chem. Abstr.* **18**, 2419.

A NEW REACTION OF LOW-TEMPERATURE TARS.—F. Schulz and J. Prunet. *Bull. soc. chim.* **35**, 638. *Chem. Abstr.* **18**, 2420.

THE QUESTION OF LOW-TEMPERATURE TAR PRODUCTION AND REFINING.—M. Dolch. *Z. für angew. Chem.* **34**, 648. *Chem. Abstr.* **18**, 2420.

THE RELATION OF COAL TO A BRITISH OIL INDUSTRY.—*Petr. Times* **12**, 349.

CRITICAL DISCUSSION OF THE DRYING OF CRUDE BROWN COAL.—J. Steinert. *Braunkohle* **23**, 151. *Chem. Abstr.* **18**, 2594.

LOW-TEMPERATURE DISTILLATION OF NATIONAL FUELS.—M. G. Levi and C. Padovani. *Atti. congresso naz. chim. pura applicata* **1923**, 249. *Chem. Abstr.* **18**, 2594.

LOW-TEMPERATURE CARBONISATION OF HUNGARIAN COALS.—E. Lozlo. *Brennstoff-Chem.* **5**, 69. *Chem. Abstr.* **18**, 2597.

PRACTICAL COAL CARBONISATION.—A. R. Powell. *Mech. Eng.* **46**, 389. *Chem. Abstr.* **18**, 2597.

COMPARATIVE STUDY OF SOME COAL TARS PRODUCED BY LOW-TEMPERATURE CARBONISATION.—K. B. Edwards. *J. Soc. Chem. Ind.* **43**, 143T, 149T. *Chem. Abstr.* **18**, 2597.

IMPROVEMENT (LOW TEMPERATURE CARBONISATION) OF COAL.—M. W. Neufeld. *Ind. u. Technik* **5**, 112. *Chem. Zentr.* **95**, II., 904. *J. Soc. Chem. Ind.* **43**, B739.

COAL CARBONISATION.—H. D. Porter. Chemical Catalog Co., New York.

DISTILLATION AND GASIFICATION OF LIGNITE.—C. Arnemann. *Z. angew. Chem.* **37**, 713.

HIGH- AND LOW-TEMPERATURE COAL CARBONISATION.—F. W. Sperr. *Gas Age-Record* **54**, 41. *Chem. Abstr.* **18**, 2799.

LIGNITE-PARAFFIN OIL, A BENZENE WASH-OIL NOT REQUIRING REGENERATION.—A. Thau. *Gas. u. Wasserfach.* **67**, 163. *Chem. Abstr.* **18**, 2799.

DIRECT UTILISATION OF LOW-TEMPERATURE TAR BY THERMAL TREATMENT.—F. Fischer, H. Schrader, & C. Zerbe. *Ges. Abhandl. Kennt. Kohle* **6**, 145. *Chem. Abstr.* **18**, 2800.

REMARKS ON THE COMMUNICATION OF H. BROCHE: "THE PRIMARY TAR OBTAINED FROM THE COAL OF THE FÜRST HARDENBERG MINE, ESPECIALLY ITS CONTENT IN BENZENE, CARBOLIC ACID AND ACETONE."—F. Schütz, W. Buschmann, and H. Wissebach. *Ber.* **57B**, 619.

REMARKS ON THE COMMUNICATION OF F. FISCHER: "RELATIONS BETWEEN PRIMARY TAR, COKING TAR AND PETROLEUM, ETC."—F. Schütz. *Ber.* **57B**, 623

LOW-TEMPERATURE COKING OF HUNGARIAN COAL.—E. László. *Brennstoff-Chem.* **5**, 69. *Chem. Abstr.* **18**, 2800.

POTENTIALITIES OF LOW-TEMPERATURE DISTILLATION IN THE CONSERVATION OF OUR FUEL RESOURCES.—V. Z. Caracristi. *Chem. Age (New York)* **31**, 361.

SURVEY OF LOW-TEMPERATURE CARBONISATION.—C. V. McIntire. *Chem. Age (New York)* **13**, 449.

REMARKABLE STRIDES MADE IN PRODUCTION OF LIQUID FUELS FROM COAL.—*Automotive Industries* **49**, 432.

LA DISTILLATION DES LIGNITES.—*Rev. Scientifique. Le Courrier des pétroles* **4**, (40), 2.

SUBSTITUTE AUTOMOTIVE FUELS OBTAINED FROM LIGNITE AND PEAT.—P. M. Heldt. *Auto. Ind.* **49**, 536.

PREPARATION AND PURIFICATION OF MONTAN WAX.—Sedlaczek. *Kunststoffe* **14**. 1. *Chem. Abstr.* **18**, 2594.

PATENTS.

PREPARATION OF MONTAN WAX OR ITS TRANSFORMATION PRODUCTS.—Farbw. vorm. Meister, Lucius, und Brüning, Assignees of K. Daimler. Ger. Pat. 392,236. *J. Soc. Chem. Ind.* **43**, B589.

PREPARATION OF HIGH-GRADE GAS, LOW-TEMPERATURE TAR, AND SEMI-COKE.—J. Rude. Ger. Pat. 389,866. *J. Soc. Chem. Ind.* **43**, B588.

OBTAINING LIGHT OILS FROM DISTILLATION GASES.—Gelsenkirchener Bergwerks-Akt.-Ges. Abteilung Schalke and H. Hock. Brit. Pat. 216,140. *Chem. Age* **11**, 102.

DISTILLATION APPARATUS AND PROCESS (FOR LOW-TEMPERATURE COKE PRODUCTION).—R. D. Lamie. U.S. Pat. 1,493,758. *J. Soc. Chem. Ind.* **43**, B663.

PREPARATION OF RESINS AND WAXES FROM CRUDE MONTAN WAX, OR BITUMINOUS COAL.—E. Jena. Ger. Pat. 386,708. *J. Soc. Chem. Ind.* **43**, B641.

TREATING TAR OR TAR OILS.—Rutgerswerke Akt.-Ges. Brit. Pat. 213,249. *Chem. Abstr.* **18**, 2240.

Low-temperature Coke Production.—A. B. Helbig. U.S. Pat. 1,497,333. *Chem. Abstr.* **18**, 2422.

Retort Furnace (for Low-temperature Carbonisation).—C. V. McIntire. Brit. Pat. 218,802.

Distillation of Coal.—A. S. Ramage. Brit. Pat. 214,222. *Chem. Abstr.* **18**, 2598. *Chem. Age* **10**, 629.

Carbonising Coal or other Fuels.—W. E. Davies. Brit. Pat. 213,040. *Chem. Abstr.* **18**, 2599. *J. Soc. Chem. Ind.* **43**, B500.

Low-temperature Distillation.—E. Barts. U.S. Pat. 1,497,083.

Obtaining Valuable Hydrocarbons from Material of Inferior Value —G. Linnmann. Brit. Pat. 214,940. *J. Soc. Chem. Ind.* **43**, B778.

Separation of the Aliphatic and Aromatic Constituents of Low-temperature Tar.—Gelsenkirchener Bergswerks-A. G. Abt. Schalke and F. Schütz. Ger. Pat. 389,471. *J. Soc. Chem. Ind.* **43**, B780.

Dry Distillation of Lignite or other Fuels.—O. Hellman. Brit. Pat. 214,675. *Chem. Age* **10**, 577. *Chem. Abstr.* **18**, 2801.

Coal Carbonisation.—S. R. Illingworth. Can. Pat. 240-898-9. *Chem. Abstr.* **18**, 2802.

19. Pitch, Asphalt and Bitumen.

U.S. Government Master Specification for Asphalt for Waterproofing and Damp-proofing.—*U.S. Bur. Standards Circ.* 160.

U.S. Government Master Specification for Asphalt for Mineral-surfaced Roofing —*U.S. Bur. Standards Circ.* 159. *J. Soc. Chem Ind.* **43**, B174.

U.S. Government Master Specification for Asphalt Primer for Roofing and Waterproofing.—*U.S. Bur. Standards Circ.* 162. *J. Soc. Chem. Ind.* **43**, B714.

Bituminous Limestones of Abruzzi and their Possible Utilisation through Distillation.—D. Meneghini. *Giorn. chim. ind. applicata* **5**, 545. *Chem. Abstr.* **18**, 2072.

Bituminous Sands of Northern Alberta.—S. C. Ells. *Canada Dept. of Mines Rept. Petr. World* **21**, 328.

The Oiling of Earth Roads.—W. N. Wilson. *Eng. Experiment Station University of Illinois Circ. II.*

Bituminous Sands and their Use for Road Surfacing Material. II; —S. C. Ells. *Nat. Petr. News* **16**, (17), 75. *Chem. Abstr.* **18**, 2232.

Insulating Mediums called "Compounds."—H. W. L. Bruckmann. *Rev. gén. élec.* **14**, 534. *Science Abstracts* **27B**, 104. *Chem. Abstr.* **18**, 2397.

Bentonite helps Solve Problem in Grinding Asphalt.—H. S. Spence. *Chem. Met. Eng.* **30**, 986. *Chem. Abstr.* **18**, 2425.

CHICAGO HEAVY-TRAFFIC STREET TESTS ASPHALT MIXTURE.—H. W. Skidmore. *Eng. News Record* **91**, 1060.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 120 TO 150 PENETRATION, FOR USE IN ASPHALT MACADAM PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 730.

TENTATIVE SPECIFICATION FOR ASPHALT CEMENT, 90 TO 120 PENETRATION, FOR USE IN ASPHALT MACADAM PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 729.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 70 TO 90 PENETRATION, FOR USES IN ASPHALT MACADAM PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 728.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 60 TO 70 PENETRATION, FOR USE IN SHEET ASPHALT, ASPHALTIC CONCRETE AND ASPHALT MACADAM PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 727.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 50 TO 60 PENETRATION, FOR USE IN SHEET ASPHALT AND ASPHALTIC CONCRETE PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 726.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 40 TO 50 PENETRATION, FOR USE IN SHEET ASPHALT AND ASPHALTIC CONCRETE PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 725.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 30 TO 40 PENETRATION, FOR USE IN SHEET ASPHALT AND ASPHALTIC CONCRETE PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 723.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 25 TO 30 PENETRATION, FOR USE IN SHEET ASPHALT AND ASPHALTIC CONCRETE PAVEMENTS.—*J. Amer. Soc. Testing Mat.* **23**, (1), 721.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 15 TO 25 PENETRATION, FOR THE MANUFACTURE OF ASPHALT ROCK.—*J. Amer. Soc. Testing Mat.* **23**, (1), 720.

TENTATIVE SPECIFICATIONS FOR ASPHALT CEMENT, 10 TO 15 PENETRATION, FOR THE MANUFACTURE OF ASPHALT BLOCK.—*J. Amer. Soc. Testing Mat.* **23**, (1), 719.

PATENTS.

WATERPROOF PAVING MATERIAL.—P. Hubbard, C. S. Reeve and R. H. Lewis. U.S. Pat. 1,495,260. *Chem. Abstr.* **18**, 2232.

ROOFING MATERIAL.—K. Schutte. U.S. Pat. 1,494,380. *Chem. Abstr.* **18**, 2232.

ARTIFICIAL ASPHALTS.—H. Goodwin, H. Smith and Building Accessories and Flooring Co., Ltd. Brit. Pat. 212,188. *Chem. Abstr.* **18**, 2246.

COLOURED ASPHALT MIXTURES.—H. Goodwin, H. Smith and Building Accessories and Flooring Co., Ltd. Brit. Pat. 212,106. *Chem. Abstr.* **18**, 2246.

BITUMINOUS PAVEMENT.—W. E. Hacker, U.S. Pat. 1,500,451.

BITUMINOUS PAVING COMPOSITION.—S. Burton. Brit. Pat. 213,659. *Chem. Abstr.* **18**, 2416.

METHOD OF OBTAINING STABLE AQUEOUS EMULSIONS OF PITCH AND OTHER UNSAPONIFIABLE MATTER.—F. C. Thornley, F. F. Tapping and O. Reynard. Brit. Pat. 219,348. *Chem. Age* **11**, 221.

SYNTHETIC MINERAL ASPHALT AND METHOD OF MANUFACTURING THE SAME.—A. G. Saunders. Brit. Pat. 218,750. *J. Soc. Chem. Ind.* **43**, B749.

20. PARAFFIN, OZOKERITE, VASELINE.

SOLID PARAFFINS OF PETROLEUM.—M. A. Rakusin. *Petroleum* **20**, 951. *J. Soc. Chem. Ind.* **43**, B702.

CERESINS.—S. Lawson. *Oil Engineering and Finance* **5**, 522.

21. ORIGIN OF PETROLEUM.

FORMATION OF CERESIN HYDROCARBONS FROM MONTAN WAX. ORIGIN OF PETROLEUM.—J. Marcusson. *Z. angew. Chem.* **37**, 413. *J. Soc. Chem. Ind.* **43**, B660.

THE GENESIS OF PETROLEUM.—L. Balliet. *Oil Age* **21**, (2), 10; (3), 9 (5), 16. *Chem. Abstr.* **18**, 2116.

VANADIUM IN PETROLEUM.—E. S. Porter. *Min. and Met.* **5**, 133. *Chem. Abstr.* **18**, 2307.

ANIMAL FATS AS THE SOURCE OF PETROLEUM.—*Petr. Times* **12**, 412.

WHY OXYGEN IS ABSENT FROM PETROLEUM.—*Petr. Times* **12**, 448.

THE ORIGIN OF PETROLEUM.—A. Prister. *Russ. min. met. chim.* **60**, 57. *Chem. Abstr.* **18**, 2671.

THE ORIGIN OF PETROLEUM.—E. Cortese. *Russ. min. met. chim.* **60**, 96 *Chem. Abstr.* **18**, 2671.

THEORIES OF THE ORIGIN OF PETROLEUM.—A. Prister. *Russ. min. met. chim.* **60**, 98. *Chem. Abstr.* **18**, 2671.

22. PHYSICAL PROPERTIES OF PETROLEUM AND ITS PRODUCTS.

SPECIFIC HEATS OF LUBRICATING OILS.—E. H. Leslie and J. C. Geniesse. *Ind. and Eng. Chem.* **16**, 582. *J. Soc. Chem. Ind.* **43**, B624.

THE VISCOSITY OF OILS AT HIGH TEMPERATURES.—A. R. Fortsch and R. E. Wilson. *Ind. Eng. Chem.* **16**, 789. *J. Soc. Chem. Ind.* **43**, B777. *Chem. Abstr.* **18**, 2803.

THE MECHANICAL PROPERTIES OF FLUIDS. A Collective Work.—D. VAN Nostrand Co., New York.

THE ORIENTED-WEDGE THEORY OF EMULSIONS AND THE INVERSION OF EMULSIONS.—W. D. Harkins and E. B. Keith. *Science* **59**, 463. *Chem. Abstr.* **18**, 2095.

VISCOSITY OF MINERAL OILS. LAW OF MIXTURES.—C. Leu. *Mon. pétrole Roumain* **23**, 1672; **24**, 615. *Chem. Abstr.* **18**, 2241. *J. Soc. Chem. Ind.* **43**, B586.

THE SURFACE TENSION OF OIL-IN-WATER AND WATER-IN-OIL EMULSIONS. I.—S. S. Joshi. *Kolloid-Zeit.* **34**, 197. *Chem. Abstr.* **18**, 2448.

VISCOSITY-TEMPERATURE CURVES OF FRACTIONS OF TYPICAL AMERICAN CRUDE OILS. (2nd Paper.)—F. W. Lane and E. W. Dean. *Ind. and Eng. Chem.* **16**, 905.

FLUIDITY ANOMALIES IN REFINED MINERAL OIL.—K. P. Monroe. *Ind. and Eng. Chem.* **16**, 534. *Chem. Abstr.* **18**, 2803.

FLUIDITY ANOMALIES IN REFINED MINERAL OIL.—E. C. Bingham. *Ind. and Eng. Chem.* **16**, 535. *Chem. Abstr.* **18**, 2803.

VISCOSITY AND SURFACE TENSION OF OILS.—J. Don. *Kolloid-Zeit.* **34**, 312. *Chem. Abstr.* **18**, 2803.

23. CHEMISTRY OF PETROLEUM.

OXIDATION OF PETROLEUM OILS BY AIR.—B. Tütünnikoff. *Z. angew. Chem.* **37**, 300. *J. Soc. Chem. Ind.* **43**, B624. *Chem. Abstr.* **18**, 2423.

SOME ORGANIC COMPOUNDS USUALLY ASSOCIATED WITH CRUDE PETROLEUM OIL.—J. E. Hackford. *Oil Engineering and Finance* **5**, 405, 461.

ADSORPTION OF RESINOUS SUBSTANCES AND PARAFFIN WAXES.—L. Gurwitsch and N. Tschernojukow. *Petroleum* **20**, 903. *J. Soc. Chem. Ind.* **43**, B661.

CHEMICAL NATURE OF THE NAPHTHENIC ACIDS. I.—N. D. Zelinsky and A. Chuksanov. *Ber.* **57B**, 42. *Chem. Abstr.* **18**, 2148.

DISTRIBUTION OF SULPHUR IN PETROLEUM.—N. A. C. Smith and D. D. Stark. *U.S. Bureau Mines Repts. Investigations* 2582. *Oil and Gas J.* **23**, (21), 92. *Petr. World (Calif.)* **9**, (5), 70. *Chem. Abstr.* **18**, 2241. *Petr. Times* **11**, 653, 724. *Petr. World*, **21**, 226. *Oil Weekly* **33**, (8), 32.

THE OXIDATION OF MINERAL OILS BY AIR.—J. Kryspin. *11th Rept. Fuel Tech. Inst. Czech. Polytech. Highschool, Prague*, 1922-3. *Chem. Abstr.* **18**, 2242.

NAPHTHENIC ACID. III. NAPHTHENIC ACIDS FROM KUBIKI KEROSENE DISTILLATE.—Y. Tanaka and S. Nagai. *J. Chem. Ind. (Japan)* **26**, 1115. *Chem. Abstr.* **18**, 2332.

SECONDARY ALCOHOLS FROM PETROLEUM.—L. M. Fanning. *Oil and Gas J.* **23**, (3), 66. *Chem. Abstr.* **18**, 2423.

COLOUR IN CRACKED GASOLINE.—B. T. Brooks and H. O. Parker. *Petr. Age* **14** (1), 42.

SOLUBILITY OF GASOLINE (HEXANE AND HEPTANE) IN WATER AT 25°.—L. H. Milligan. *J. Phys. Chem.* **28**, 494. *Chem. Abstr.* **18**, 2452.

ELEMENTS ASSOCIATED WITH PETROLEUM.—J. E. Hackford. *Oil Engineering and Finance* **5**, 344. *Chem. Abstr.* **18**, 2488.

THE ACTION OF OZONE ON HYDROCARBONS WITH SPECIAL REFERENCE TO THE PRODUCTION OF FORMALDEHYDE.—E. W. Blair, T. S. Wheeler and W. LEDBURY. *J. Soc. Chem. Ind.* **43**, 287T.

NOTE ON THE ACTION OF BROMINE ON *n*-HEXANE.—E. W. Blair, W. Ledbury and T. S. Wheeler. *J. Soc. Chem. Ind.* **43**, 289T.

A SUGGESTED MECHANISM FOR ANTI-KNOCK ACTION.—G. L. Wendt and F. V. Grimm. *Ind. and Eng. Chem.* **16**, 890.

RELATIVE EFFECTS OF SOME NITROGEN COMPOUNDS UPON DETONATION IN ENGINES.—T. A. Boyd. *Ind. and Eng. Chem.* **16**, 893.

SOLUBILITY OF THE PETROLEUM HYDROCARBONS.—C. F. Mabery. *Ind. and Eng. Chem.* **16**, 937.

PHYSICO-CHEMICAL INVESTIGATIONS OF COMPOUNDS OF THE CYCLOHEXANE SERIES.—W. Herz and W. Bloch. *Z. phys. Chem.* (June 25), 23.

ACTION OF SULPHUR ON HYDROCARBONS.—W. Beilenberg. *Braunkohlenarchiv* **4**, 40. *Chem. Zentr.* **95**, II., 1041. *J. Soc. Chem. Ind.* **43**, B777.

COMPOSITION OF MELENE.—J. Marcusson and F. Bottger. *Ber.* **57B**, 633. *J. Soc. Chem. Ind.* **43**, B457. *Chem. Abstr.* **18**, 2681.

CHEMICAL NATURE OF THE NAPHTHENIC ACIDS.—O. Aschan. *Ber.* **57B**, 636. *J. Soc. Chem. Ind.* **43**, B458. *Chem. Abstr.* **18**, 2688.

NAPHTHENIC ACIDS. IV. METALLIC SALTS OF NAPHTHENIC ACIDS.—Y. Tanaka, K. Horiuchi and G. Oyama. *J. Chem. Ind.* (*Japan*) **26**, 1190. *Chem. Abstr.* **18**, 2688.

MAXIMUM TEMPERATURES AND PRESSURES IN THE COMBUSTION OF GASEOUS AND LIQUID FUELS.—G. A. Goodenough and G. T. Felbeck. *Univ. Illinois Bull.* 21. *Chem. Abstr.* **18**, 2799.

THE REACTIONS INVOLVED IN BLOWING PETROLEUM RESIDUAL OILS AND TARS.—J. Marcusson and M. Picard. *Chem. Zeit.* **48**, 338. *Chem. Abstr.* **18**, 2802. *J. Soc. Chem. Ind.* **43**, B624.

VOLATILE YELLOW COLOURING MATTER IN CRACKED GASOLINE.—B. T. Brooks and H. O. Parker. *Ind. and Eng. Chem.* **16**, 587. *Chem. Abstr.* **18**, 2803.

PATENTS.

CHLORHYDRINS FROM STILL GASES.—B. T. Brooks, assgd. to Chadeloid Chemical Co. U.S. Pat. 1,498,781-2. *Chem. and Met. Eng.* **31**, 198. *Chem. Abstr.* **18**, 2600.

HALOGENATING HYDROCARBONS.—H. T. Tizard, D. L. Chapman and R. Taylor. Brit. Pat. 214,293. *Chem. Abstr.* **18**, 2523. *Chem. Age* **10**, 545. *J. Soc. Chem. Ind.* **43**, B577.

24. Oil and Petrol Gas.

Patents.

Retort for Gasifying Oil and Tar.—J. E. Sharp and A. J. Bassett. U.S. Pat. 1,496,609. *J. Soc. Chem. Ind.* **43**, B625.

Production of Oil Gas.—J. E. Hackford. Brit. Pat. 217,613. *Chem. Age* **11**, 100.

Manufacture of Gas.—Humphreys and Glasgow, Ltd. From P. T. Dashiel. *J. Soc. Chem. Ind.* **43**, B703.

Process of Treating Hydrocarbons.—J. H. Riddick. U.S. Pat. 1,496,742. *Nat. Petr. News* **16**, (33), 75.

25. Miscellaneous.

How the Petroleum Industry is Solving its Corrosion Problems.—*Chem. and Met. Eng.* **31**, 42.

Crude Oils and Refined Products.—J. L. Strevens. *Chem. Eng. Mining Rev.* **16**, 213.

Handbook of Fire Protection.—E. U. Crosby, H. A. Fiske and H. W. Forster. D. Van Nostrand Co., New York.

National Standard Petroleum Oil Tables.—*U.S. Bureau Standards Circ.* 154. *Oil News* **16**, 153.

Corrosion Problems in the Petroleum Industry.—*Petr. Times* **12**, 275.

Drilled 2000 ft. before Drake's Time.—W. H. Gallaher. *Oil and Gas J.* **23**, (9-A), 28.

Factors involved in Valuations of Gasoline and Gas Contracts.—A. B. Morris. *Nat. Petr. News* **16**, (31), 67,

Formation of Artificial Petroleum from Squalene and Cholesterol.—S. Kawai and S. Kobayashi. *J. Chem. Ind.* (*Japan*) **26**, 1036. *Chem. Abstr.* **18**, 2240.

The Chemical Principles in the Utilisation of Fuels.—W. Frankenstein. *Z. tech. physik* **5**, 293. *Chem. Abstr.* **18**, 2797.

Petroleum from Plant and Animal Fats.—A. Fabor. *Petroleum* **20**, 727. *Chem. Abstr.* **18**, 2423.

Synonyms for Oil and Oil Products in Various Countries.—*Petr. World* **21**, 251. *Chem. Abstr.* **18**, 2425.

The Synthetic Production of Liquid Fuels.—G. Gallo and R. Correlli. *Atti. Congresso naz. chim. pura applicata* **923**, 257. *Chem. Abstr.* **18**, 2594.

Petroleum and its Derivatives.—C. Leu. *Mon. Pétrole Roumain* **24**, 697.

Appraisal of Oil and Gas Properties.—R. H. Johnson and P. Ruedemann. *Nat. Petr. News* **16**, (32), 55; (33), 68, (35), 63.

HEAT AND POWER RESEARCH IN PETROLEUM.—H. C. Dickinson. *Oil and Gas J.* **23**, (11-A), 41.

HANDBOOK OF PETROLEUM, ASPHALT AND NATURAL GAS.—R. Cross. 1924 edition revised and rewritten. Kansas City Testing Laboratory, Kansas City, Mo.

EFFECT OF OIL POLLUTION OF COAST WATERS ON THE PUBLIC HEALTH.—F. W. Lane, A. D. Bauer, H. F. Fischer and P. N. Harding. *Public Health Repts.* **39**, 1657.

LA HOUILLE ET LE PROBLÈME DES COMBUSTIBLES LIQUIDES.—E. Audibert. *Chem. et Ind.* **10**, 613.

THE STORY OF OIL.—*Scientific Amer.* **129**, 256.

PATENT.

HYDROCARBON OILS.—A. Mailhe. Brit. Pat. 218,278. *Chem. Age* **11**, 245.

PETROLEUM DIVISION

OF THE

AMERICAN CHEMICAL SOCIETY.

Abstracts of papers submitted to the Ithaca, New York, Meeting, September 10th and 11th, 1924.

THE CHEMISTRY OF "SWEETENING" IN THE PETROLEUM INDUSTRY.—Gerald L. Wendt and S. H. Diggs.

Although naphthas and kerosenes have been sweetened by the sodium plumbite method for many years the process is entirely empirical and the chemical reactions have not been understood. The present paper shows that sweetening consists in the removal of hydrogen sulphide and of alkyl mercaptans which are the only compounds responsible for sourness. Other compounds, including free sulphur, sulphides and disulphides do not give the doctor test. The reactions involved in the use of sodium plumbite with hydrogen sulphide and with alkyl mercaptans have been studied in detail and have furnished explanations of the various complications which appear in sweetening, including the coloration of the precipitate, the coloration of the oil, the function of free sulphur, the occasions on which sulphur is required, the differences between sweetening gasolines, kerosenes and pressure distillate and the sourness developed in rerunning a sweetened oil.

THE ACTION OF PETROLEUM REFINING AGENTS ON PURE ORGANIC SULPHUR COMPOUNDS DISSOLVED IN NAPHTHA.—A. E. Wood, with A. Lowy and W. F. Farragher.

A study of the action of sulphuric acid, sodium plumbite, copper oxide, aluminium chloride and sodium hypochlorite on naphtha solutions of the alkyl sulphides, alkyl disulphides, mercaptans, thiophene, free sulphur, hydrogen sulphide, carbon bisulphide, etc.

CRANK CASE DILUTION.—C. M. Larson.

This paper proposed to outline the actual facts of dilution of crank case oil without attempting to delve too deeply into the causes for crank case dilution or remedial measures to correct dilution. Data was gathered from dynamometer laboratory test work of scientific accuracy and also from actual road performance of automobiles. Curves are developed to display the relationship of dilution effect on engine performance. Other curves show the change of characteristics as the oil becomes diluted as related to consumption and economy of fuel and lubricant, as well as to engine performance. The article refers to two simple devices by the use of which the motorist can determine when his oil has become unfit for further use and may be considered dangerous. These devices constitute a pocket laboratory, and make it possible for the motorist to determine the proper times for changing crank case oil based on the condition of the oil, and not on arbitrary or average mileage.

THE EFFECT OF CRANK CASE DILUTION.—D. P. Barnard.

This paper gives the results of a series of car and engine tests in which the rate of wear was estimated from analyses of samples of crank case oils for suspended iron. The results indicate that at dilutions above 10–15% the rate of cylinder and ring wear increases markedly.

DISTRIBUTION OF SULPHUR IN PETROLEUM AND ITS FRACTIONS.—A. P. Bjerregaard.

Determinations of the sulphur content in a considerable number of American crude petroleums have been made together with determinations of the sulphur content of the fractions from the same crude petroleums. The results are given as percentages in the products analysed and also in percentages of the sulphur in the original crude, thus showing the per cent. distribution of the sulphur in the several fractions into which the crude oil was separated.

A NEW SUGGESTED METHOD OF REFINING PETROLEUM.—R. H. Brownlee.

The theory is advanced that the refinery of the immediate future will be vastly simplified as compared with existing complete refineries. Many existing plants will operate for many years to come, but a company building a new plant of present type, in the estimation of the writer, will be making a serious mistake. The new type of plant will be primarily a cracking plant. Lubricants will be made from the residue. Lubricants superior to existing grades for internal combustion motors, will be manufactured by polymerisation of the unsaturated hydrocarbons from the cracking process.

A COMPARISON OF SEVERAL METHODS OF COLOUR MEASUREMENT WITH A TRUE COLOUR SCALE.—T. H. Rogers.

The determination of the colour of oil by the three methods in common use—namely, the Saybolt chromometer, the Tag-Robinson colorimeter and the Union colorimeter, gives rise to three unscientific methods of expressing colours which have no relation to each other. The method of colour measurement developed by Parsons and Wilson possesses considerable refinement over these methods in the manner of making the colour determination and expresses the results on a true colour scale in which the colours are proportional to the amount of colouring matter present and are, therefore, additive. The colours of a series of oils have been measured by the various methods, from which a chart has been prepared, showing the relations between the several colour scales. The advantages of expressing colours on a true colour scale for investigational work are discussed, and the use of the conversion chart for calculating the colours of mixtures is explained.

THE MEASUREMENT OF THE ABSOLUTE VISCOSITY OF LIGHT DISTILLATES WITH THE SAYBOLT THERMO VISCOMETER.—A. R. Fortsch and R. E. Wilson.

In order to secure reliable data on the absolute viscosities of light liquids, such as gasoline, kerosene, etc., for use in calculating the flow of fluids and the flow of heat, it seemed desirable to calibrate the Saybolt thermo viscometer in absolute units. Although this instrument is most universally used to measure the viscosity of light liquids, there seems to be no published data as to the relation between the observed time of flow and the true viscosity of the fluid. By measuring both the absolute viscosity and the thermo viscosity of a number of light

petroleum fractions, a satisfactory calibration curve was obtained and is presented in this paper. This curve does not apply with accuracy to liquids whose capillary rise is not very similar to that of the light hydrocarbons used in calibrating it. Means are suggested by which the Saybolt thermo viscometer might be changed so as to give reliable readings on all liquids regardless of the capillary rise. On the whole, however, the instrument is not well suited for measuring absolute viscosities except for a limited class of oils of similar surface tension.

THE EFFECT OF "ANTI-KNOCK" AND "KNOCK INDUCING SUBSTANCES" ON THE HOT WIRE IGNITION CURVES OF CERTAIN PURE FUELS.—C. E. Boord and Raymond E. Schaad.

When the vapours of certain pure fuels such as toluene, amylacetate and normalpropyl alcohol are brought into contact with an electrically heated platinum wire, the amount of current necessary to put through the wire in order to ignite the explosive vapour falls through a min-point as the richness of the mixture is increased through the explosion interval. The presence of "anti-knock" such as lead netraethyl, selenium diethyl, ethyliodide or aniline increases the amount of current necessary to put through the same wire to explode the vapour of the same fuel. The presence of a "knock inducing material" such as propyl nitrite amylnitrite or nitrobenzene decreases the amount of current necessary to produce an explosion. In other words, the presence of an "anti-knock" in a fuel mixture increases the hot wire ignition temperature while the presence of a knock-inducing substance decreases this temperature.

A TURBINE OIL DEPOSIT.—A. G. Blakely.

This paper describes a brown powder deposit taken out of the water-cooling compartment of a Ridgway turbine. It consisted of:—

	Per cent.
Water	0·5
Oil	43·3
Metallic soap, etc.	50·4
Asphaltic matter	2·2
Insoluble matter	4·4

PROGRESS IN THE CHEMISTRY OF CRACKING.—J. A. Boyd.

A résumé of progress in the chemistry of cracking. Points discussed include: (1) Minimising the amount of oil in the cracking zone. (2) Decreasing the formation of carbon. (3) High pressures to prevent distillation in the high-temperature apparatus. (4) By-products from still gases. (5) Treating cracked naphthas. (6) Important problems still to be solved.

CRACKING OF LOW-TEMPERATURE COAL TAR AND CONVERSION PRODUCTS.—Jacque C. Morrell and Gustav Egloff.

This paper describes experiments covering the cracking of two different low-temperature carbonisation products. These products were a dry tar, sp. gr. 1·068 (Be. gr. 1·0) and a neutral oil, sp. gr. 0·9484 (Be. gr. 17·7). Results obtained were very encouraging from a viewpoint of the production of motor fuels.

PRESENT STATUS OF THE NATURAL GASOLINE INDUSTRY.—George A. Burrell.

This paper discusses advances in the art of extracting gasoline from natural gas. It discusses the compression, absorption and charcoal

processes, the Rafferty Stabiliser, treatment of natural gasoline, economics of the industry and future trend.

THERMAL RELATIONS IN CRACKING AND DISTILLING OF OIL.—Roy Cross.

The data given in this paper are the observations in the cracking of oil in the liquid phase under very high pressure with its subsequent distillation at approximately atmospheric pressure. At a pressure of 650 pounds, which is the normal operating pressure of the Cross process, there is practically no heat used up in vaporisation although the gasoline and gaseous hydrocarbons exist largely in the vapour phase. The temperature of reaction is considerably above the critical temperatures of the hydrocarbons.

The temperatures and pressures of the oil at the various stages are as follows :—

		Temperature.	Approximate Pressure.
		° F.	lbs.
1.	Charged oil	80	700
2.	Oil from heat exchanger reflux coil	324	700
3.	Furnace transfer	550	675
4.	Oil from furnace	850	650
6.	Oil reaction chamber	810	650
7.	Synthetic crude to reboiler	710	50
8.	Oil from reboiler	670	40
9.	Refluxed oil in bubble tower	624	28
10.	Oil on tray No. 2	577	28
11.	„ No. 6	539	28
12.	„ No. 15	485	27
13.	„ No. 30	429	25
13a.	Vapour above tray No. 30	402	25
14.	Vapour outlet from fractionating tower	338	25
15.	Residue in vaporizer	632	30
16.	Vapour from vaporizer	618	30
17.	End point gasoline from condenser	80	15

The above gives the amount of heat consumed in various stages of the process. It is particularly to be noted that in the fractionating tower or bubble tower operation at least a 4 degree drop in temperature for each tray is required for good fractionation unless the number of trays is excessive.

In the cracking of oil in the liquid phase at 650 pounds pressure the amount of heat contained by one pound of the oil when it issues from the furnace tubes and enters the reaction chamber in excess of that in the charged oil is 462 B.T.U. per pound.

Distribution of this heat in a single cycle when no refluxed or hot oil is returned to the system is as follows, based upon each pound of oil charged.

	B.Th.U.
0·337 lb. gasoline	88·0
0·567 lb. gas oil recharging stock	191·1
0·056 lb. fuel oil	18·5
0·037 lb. fixed gas	7·0
0·003 lb. carbon	0·4
Heat exchanged into charged oil through reflux coil	117·0
Radiation from reaction chamber and lines	40·0
Total	462·0

DEW-POINTS OF GASOLINE-AIR MIXTURES.—R. E. Wilson and D. P. Barnard.

The cause of the discrepancy between the dew-points previously reported by Wilson and Barnard and those of W. A. Gruse has been found to lie in the change in relative volatility of different hydrocarbons with temperature. The values previously given by the writers hold closely for fuels having narrow distillation ranges. For the fuels ordinarily encountered, however, the figures given are too low. Correction of these values by allowing for the change in relative volatility gives results which practically check the observations of Gruse. This method of calculation allows of an estimate of the dew-point from the Engler distillation data of the fuel. Such an estimate is probably good to within 5° C.

DILUTE SULPHURIC ACID TREATMENT OF CRACKED DISTILLATE.—Gustav Egloff.

A series of tests made using 10 to 95 per cent. sulphuric acid concentrations on pressure distillate oil from cracking of California gas oil which yielded a water white, sweet odour, and Doctor sweet gasoline when using a concentration of 60-to 70 per cent. sulphuric acid solution. All tests were conducted using the same quantity of actual sulphuric acid per unit volume of cracked distillate. With the exception of the two concentrations noted, the gasoline ranged from deep purplish red in colour to purplish pink, with intermediate colours of light gold, light yellow and light pink.

THE CRACKING OF TOPPED LOUISIANA CRUDE AND FUEL OIL.—Jacque C. Morrell and Gustav Egloff.

The Dubbs process has cracked continuously with one passage through the apparatus 969 barrels of topped Louisiana crude oil into 41.59 per cent. gasoline; 15.9 per cent gas oil; 34.12 residue fuel oil; 7.5 tons of dry coke and 163,000 cubic feet of uncondensable gas.

LOUISIANA FUEL OIL.

The process has also cracked continuously with one passage through the apparatus 2007 barrels of Louisiana fuel oil into 36.75 per cent. gasoline; 12.04 per cent. gas oil; 45.62 residue fuel oil; 11.8 tons of dry coke and 336,000 cubic feet of uncondensable gas.

Abstracts.

Compiled by S. F. Birch, Ph.D., S. Bowman, F.I.C., S. T. Card, B.Sc., R. W. L. Clarke, B.Sc., J. E. Marshall-Hall, A.R.S.M., H. Moore, M.Sc., A.I.C., F.C.S., W. S. Norris, Ph.D., R. Pitkethly, F. G. P. Remfrey, B.A., D.Sc., A.I.C., T. A. Smith, B.Sc., F.I.C., W. H. Thomas, A.R.S.M., and W. G. Weeks, A.R.S.M.

General.

Esterification in the Presence of Silica Gel.—C. H. Milligan, J. T. Chappell and E. Emmet Reid. *J. Phys. Chem.* **28**, 873.

The authors have found commercial silica gel containing under atmospheric conditions 17·95 per cent. of water, to be an excellent catalyst for esterification and better than thorium and titanium oxide. The percentage of esterification attained depends on the rate of passage of the vapours, being about 90 per cent. for slow rates at 150°. The limit appears to be far higher in the vapour phase than in the liquid.

S. F. B.

Formation of Artificial Petroleum from Squalene and Cholesterol.—S. Kawai and S. Kobayashi. *J. Chem. Ind.* (*Japan*) **26**, 1036–1041.

Good yields of hydrocarbons were obtained by heating a mixture of squalene, obtained from shark liver oil, and dried Japanese clay under ordinary pressure. The product closely resembled natural petroleum and had d. 0·8279–0·8420, C=87·58 and H=12·65 per cent. Refining with sulphuric acid increased the hydrogen ratio and reduced the iodine value from 18·9–21·1 to 1·4. It appears to consist chiefly of naphthenes together with aromatic and unsaturated hydrocarbons. Cholesterol gave similar results when submitted to the same conditions. Paraffins were found in the lower boiling fractions, however.

S. F. B.

Apparatus for Collecting a Gas at Constant Pressure.—H. J. E. Dobson. *J. Chem. Soc.*, 1924, **125**, 1968.

An aspirator has the outlet leading into a vertical tube, the upper end of which forms a U-tube with one limb open. A water supply is connected to the bottom of the U-tube and overflows from one limb to the vertical tube and from the other limb to waste. The top end of the vertical tube is also connected to the top of the aspirator thus forming a balance pipe, and the bottom end acts as the run off from the aspirator. Gas enters the aspirator and displaces the water, but any variation in pressure from the atmosphere is automatically corrected by the action of the U-tube and by raising or lowering the height of the auxiliary overflow from the open limb, the gas can be collected at any desired pressure within convenient limits. Deviation in pressure can thus be controlled to within 0·1 mm. of mercury. S. B.

VISCOSITY TEMPERATURE CURVES OF FRACTIONS OF TYPICAL AMERICAN CRUDE OILS.—F. W. Lane and E. W. Dean. *Ind. and Eng. Chem.*, 1924, **16**, 905. *Cf. Ibid.* **13**, 779.

The viscosities of the fractions from five typical American crude oils, obtained by the Bureau of Mines distillation method, have been determined at 10° intervals between 0° and 100° C. The kinematic viscosities are tabulated and plotted against temperature. The fractions from Pennsylvanian crude show the least rapid and those from the Texas crude the greatest change in viscosity for a given change of temperature. The Oklahoma, Wyoming and Californian oils are intermediate in this respect. The authors have arrived at a conclusion similar to that of Herschel, viz., that when the logarithms of the kinematic viscosity of the lubricating fractions of the same crude as ordinates are plotted against the logarithms of the Centigrade temperature plus a constant as abscissæ, the straight lines so obtained meet practically at a point. This point is differently located for different crudes. When the necessary constant for a particular crude oil has been determined, a single determination of viscosity at a suitable temperature together with the gravity at 60° F. is sufficient to define the viscosity temperature relationship of the particular fraction over a wide range. There is excellent agreement between the predicted and experimental viscosities in the cases cited. R. W. L. C.

THE VISCOSITY OF OILS AT HIGH TEMPERATURES.—A. R. Fortsch and R. E. Wilson. *Ind. and Eng. Chem.*, 1924, **16**, 789.

Experimental results and curves covering viscosity determinations of a variety of oils from mid-Continent and similar crudes up to 495° F. are given. A method of Herschel for expressing the results graphically is followed, and it is shown that curves obtained by plotting log viscosity in centipoises and log temperature in degrees Fahrenheit are practically straight lines. A method of inter- and extra-polation is suggested which should give the viscosity of an oil from a similar source up to 550° or even 600° F. from a single determination of its viscosity at ordinary temperatures. R. W. L. C.

NAPHTHENIC ACIDS. IV. METALLIC SALTS OF NAPHTHENIC ACIDS.—Y. Tanaka, K. Horiuchi and G. Oyama. *J. Chem. Ind.* (*Japan*), 1923, **26**, 1190–1203.

The authors describe metallic salts of trideca-, tetradeca- and pentadecanaphthenic acids, derived from waste lyes from the refining of Kurokawa petroleum. The solubility of the salts decreases in the order of the acids named. The lead salts (transparent, resinous solids) have m.p. 110–118°. Manganese tridecanaphthenate, a pink powder, is soluble in ether, slightly soluble in absolute alcohol, and insoluble in water; the tetra-decanaphthenate has m.p. 61–63°. The lead and manganese salts have a drying action on linseed oil. The chromium salts are green and viscous, but exist also as an unstable, violet powder, which changes into the more stable form when heated. The aluminium salts are colourless, transparent, porous and friable, and can be used for waterproofing. White calcium and zinc salts are described.
W. S. N.

CANCER-PRODUCING FACTOR IN TAR.—E. L. Kennaway. *Brit. Med. J.*, 1924, 564–567.

Examination of the industrial and experimental evidence shows that gas-works' tar, producer-gas and very probably coke-oven tar produce

cancer. The cancer-producing substance can be concentrated by distillation into the fraction boiling between 250–500°. It appears to be an unknown substance occurring in extremely small quantities, as nearly every substance known in gas-works' tar also occurs in the innocuous blast-furnace tar or in almost innocuous crude petroleum. Tests with single substances support these conclusions. S. F. B.

FORMATION OF A CANCER-PRODUCING SUBSTANCE FROM ISOPRENE.—E. L. Kennaway. *J. Pathol. Bacteriol.*, 1924, **27**, 233–238.

Whilst searching for the cancer-producing substance present in coal-tar, an artificial tar was produced by passing *iso*prene vapour and hydrogen through a silica tube filled with porous porcelain and heated to 820°. No *iso*prene appeared to be present in the issuing gases as indicated by the odour, but benzene appeared to be present. The thin tar produced at the same time produced cancer in mice more rapidly than coal-tar. From this it appears that the substance is a hydrocarbon, although the possibility of oxygen is not excluded.

S. F. B.

THE OCCURRENCE OF VANADIUM AND NICKEL IN PETROLEUM.—E. De Golyer. *Econ. Geol.*, 1924, **19**, 550.

A review of previous research. As a result of the great difficulties of investigation, very few complete analyses of petroleums have been made. Most so-called analyses are merely determinations of useful physical characteristics. The occurrence of other than the usual elements in petroleum has only recently been noticed. Kyle, in 1891, found 0·63 per cent. ash with 38·22 per cent. vanadic oxide in an Argentine asphalt. Hackford found many metals in Mexican petroleum ash, and, because marine plants absorb elements from sea-water, favours the theory of origin from marine vegetation. The presence of minute quantities of certain elements is probably due to impurities; but this does not account for the high proportion of vanadium and nickel. Dunstan comments upon the large percentage of nickel and vanadium in the ash of a Persian crude and notes that it is radio-active. Other examples of the association of asphalt and vanadium are given and Ramsay's investigations of petroleums for nickel are quoted. Ramsay found nickel in every oil examined, asphalts being richest. He suggests that the nickel may have acted catalytically in hydrogenating inorganic carbon or carbon oxides. The author considers that the evidence for the organic origin theory is too strong to be rejected, but that vanadium and nickel may have played some part in the reactions.

In the discussion following, particulars of other occurrences of vanadium were given, and it was pointed out that vanadium occurs in the ash of modern plants and other organisms, and has been found in large proportion in Holothurians. Generally it is very widely distributed.

W. G. W.

DISTRIBUTION OF SULPHUR IN PETROLEUM.—N. A. C. Smith and D. D. Stark. *Bureau Mines Rept. Investigations*, No. 2582.

Mexican crude oil was distilled until the vapour temperature reached 190° and the residual fuel oil distilled by two methods, in one using a Hempel still and in the other a coking still. A determination of the

sulphur in each cut was made. Some of this fuel oil was also extracted with acetone and benzene to remove asphalts. It was found that a large percentage of the sulphur content in the crude oil was combined in the form of a black brittle asphalt, soluble in benzene but insoluble in acetone. After this had been removed, 70 per cent. of an oil with a high sulphur percentage remained. Apparently the sulphur derivatives in the oil are similar to those present in the asphalts. The possibilities of the origin of the sulphur are discussed. S. F. B.

VOLUMES IN THE NEIGHBOURHOOD OF THE CRITICAL STATE OF MISCIBILITY. —N. Perrakis. *Comptes rend.*, 1924, **178**, 1482.

The volume changes occurring when benzene is mixed with methyl, ethyl, propyl and *n*-butyl alcohols at 20° have been determined. That the volume change is dependent on the molecular composition is shown by a series of curves. S. F. B.

CHARCOAL PLANT SHOWS GOOD YIELD.—R. C. Alden. *Refiner and Natural Gasoline Manufacturer*, 1924, **3**, 13.

A description is given of the design and working of the first charcoal adsorption plant, working on the residue gas from an oil adsorption plant, in the mid-Continent field of the U.S.A. The gas from the oil plant was first passed through two scrubbers worked in parallel in which as much as 100 gallons of mineral seal per day were collected. Three adsorber stills, each containing 40,000 lb. of charcoal, were worked in turn—adsorbing, steaming and cooling. The stripped gas was cooled and piped away for burning purposes. Gasoline vapours steamed out of the charcoal were passed through condensers and then compressed to 75 lb., cooled and sent to be mixed in with the oil adsorption gasoline. No noticeable increase of vapour tension in the bulk stock was observed when charcoal gasoline was added to that from the oil plant. The plant was designed to treat 60,000,000 cu. ft. of gas a day at 90 lb. pressure and produce 4000 gallons of gasoline. It was also to have 100 per cent. over load capacity. In practice it was found capable of producing close on 10,000 gallons a day when required. The gas leaving the oil adsorption plant yielded an average of 160 gallons per million cu. ft., which was reduced to 12 gallons per million by the charcoal plant. The charcoal plant raised the efficiency of gasoline extraction from 69 to 79 per cent. during July, and to 87 per cent. in August and has functioned without a hitch from the start.

F. G. P. R.

PROCESS OF MAKING FLOTATION OIL.—F. H. Rhodes, Assr. to the Barrett Co. U.S.P. 1,506,385. August 26, 1924. Appl., Dec. 2, 1918.

A fraction of coal tar oil boiling between 160° C. and 280° C. is found to be suitable for ore separation by the flotation process. The patent relates to the treatment of this oil to remove the pyridine bases present and the subsequent traces of acids resulting from the treatment. The crude oil is first washed with sulphuric acid sufficient to remove the bases and after settling the acid layer is drawn off. The oil now contains traces of sulphuric and sulphonic acids which are detrimental to the flotation properties of the oil. The extracted oil is therefore washed with an excess of a solution of alkali salts of the tar acids describable as a carbolate solution and the excess of this solution removed. This

treatment effectively removes any acidity and is more beneficial with regard to the flotation properties than simple washing with sodium hydrate or carbonate solution. S. B.

REMOVAL OF SULPHUR COMPOUNDS FROM GASES FREE FROM AMMONIA.—Farbenfabr. vorm. F. Bayer und Co. G.P. 398,171. June 12, 1919. Addition to 333,829.

The alkaline reaction, necessary for the removal of sulphur compounds, such as hydrogen sulphide, from ammonia free gases, by the catalytic method, using small quantities of air, described in the main patent (E.P. 153,297), can be obtained by passing the gases through a solution of ammonium salts of weak acids. In this way a constant amount of ammonia is added. The gases can be passed through the solution either before or while in contact with the catalyst. S. F. B.

PROCESS OF MAKING DRY POWDERED CALCIUM ARSENATE.—W. H. Simpson. U.S.P. 1,507,690. Sept. 9, 1924. Appl. June 14, 1923.

Calcium oxide is ground, a regulated quantity of hydrated oxide of arsenic being added during the grinding. T. A. S.

CIRCULATORY PROCESS AND APPARATUS FOR CATALYTICALLY TREATING MATERIALS. (PREPARATION OF LAMPBLACK.)—E. Hopkinson. U.S.P. 1,497,751. June 17, 1924. Appl. April 17, 1923.

Heated hydrocarbons are mixed with finely divided heated reduced copper or nickel at a jet, when lampblack is immediately produced. The mixture is delivered into a tank of water when the metallic catalyst falls to the bottom and is removed. After it has been cleansed it is returned to the process.

The lampblack separates on the top of the water and is removed and dried. Gases formed during the process are burned to heat the oil any catalyst before mixing. S. F. B.

ADSORBENT MATERIALS—IMPROVEMENT IN APPLICATION OF.—P. G. Somerville and E. C. Williams. E.P. 220,899. Feb. 23, 1923.

The use, for adsorption of liquids from gases, is claimed for silica gel substantially free from alkali salts. The preparation of such a gel is described in E.P. 219,352. F. G. P. R.

ADSORBENT MATERIALS—MANUFACTURE AND APPLICATION OF.—P. G. Somerville and E. C. Williams. E.P. 219,352. Feb. 23, 1923.

Silica gel is produced by pouring 99 parts by volume of silicon chloride into 100 parts of water with vigorous agitation. On standing for 2 to 6 hours the mixture sets to a gel, which is washed with water, dried first at 100° C. and finally at 400° C. The product is free from sodium chloride or sulphate, which lowers the adsorptive capacity of the gel manufactured by the action of acid on sodium silicate. When made as described above the gel can be heated to 900° to 1000° C. without destroying its adsorptive properties, and can therefore be easily freed from contaminating hydrocarbon compounds after use. F. G. P. R.

DECOLOURISING OIL—PROCESS FOR.—F. W. Manning. U.S.P. 1,504,772. Sept. 12, 1924.

When decolourising oil by mixing with, or filtering through, large masses of porous earths, such as fuller's earth, other undesirable changes

take place in the oil owing to the long period of contact. In order to overcome this difficulty the oil and decolourising earth are mixed in an agitator and rapidly pumped under pressure into the interior of a horizontal cylindrical rotating filter. When the filter is full of earth filtration is stopped and adherent oil removed by successively treating the earth with air, an oil solvent and dry steam under pressure. The dry earth is then removed by means of conveyors centrally situated within the filter. F. G. P. R.

METHOD OF AND APPARATUS FOR TREATING OIL SAND.—W. McArthur. U.S.P. 1,502,261. July 22, 1924. Appl. April 27, 1923.

An oil solvent is directed against the sand under pressure. The sand and solvent are then agitated together in a container and allowed to settle. After draining the sand is treated with a chemical cleaning agent. T. A. S.

IMPROVEMENTS IN OR RELATING TO MEANS FOR RAISING AND LOWERING WELL CASINGS, WELL BORING TOOLS AND THE LIKE.—E.P. 220,035.

A well elevator is described for use with small tools operating in relatively large well casings. W. H. T.

IMPROVEMENTS IN ROTARY APPARATUS FOR EARTH BORING.—E.P. 221,336.

In this invention, a rotary apparatus is provided in which there are means for permitting the use of a back-up tong and post which may be applied directly to the base member of the rotary. Arrangements are also made whereby relative movement between slips and drill stem may be avoided. W. H. T.

APPARATUS FOR SEPARATING OIL FROM OIL SANDS.—U.S.P. 1,508,923.

The oil sands are first passed through a vertical chamber where they are treated with a mixture of superheated steam and a suitable gas. The sand is then passed into a separating tank, where further disintegration takes place by the action of a number of rotary sprays, discharging steam or water. Finally, the sand is conveyed away for further treatment by dehydration and distillation. W. H. T.

IMPROVEMENTS IN OR RELATING TO MEANS FOR RAISING AND LOWERING WELL CASINGS, WELL BORING TOOLS AND THE LIKE.—E.P. 220,270.

The elevator described comprises a body having open hook-like portions for engaging supporting means, together with pawls pivotally engaged to the body. The pawls automatically keep the hook-like portions of the body obstructed when the body is in a lifted position and are adapted to move to open position when the body is in resting position. W. H. T.

IMPROVEMENTS IN OR RELATING TO MEANS FOR RAISING AND LOWERING WELL CASING, WELL BORING TOOLS AND THE LIKE.—E.P. 220,268.

The object of this invention is to provide an improved elevator wherein the use of slips, tongs or forks is dispensed with. The apparatus provides means for clamping the objects to be lifted and posseses means of suspension removably secured to the clamping device. A broad base is provided whereby the elevator can rest on the open end of the well casing. W. H. T.

IMPROVEMENTS IN AND RELATING TO APPARATUS FOR CONTROLLING OIL WELLS.—E.P. 220,410.

The apparatus described comprises a member composed of sections carrying packing and hinged together so that they may be moved radially away from or towards the drill pipes or casing. The sections can be opened or closed, and means are provided whereby they may be moved lengthwise of the drill pipes or casing. W. H. T.

IMPROVEMENTS IN THE CONSTRUCTION OF JARS FOR USE WITH EARTH AND ROCK BORING APPARATUS.—E.P. 220,470.

The invention relates to improvements in jars where the shock of impact on the up stroke is damped by a compound spring device constructed of rubber and steel rings. Arrangements are also made, whereby a stream of scavenging water can pass from the boring bar through the tool-carrying bar to the boring tool. W. H. T.

IMPROVEMENTS IN EARTH-BORING APPARATUS.—E.P. 215,723.

The invention relates to deep-boring apparatus, wherein strata of earth or rock are penetrated by alternate use of rotary boring tools and percussive tools. The rotary boring rod is driven from a prime mover through gearing which can be disconnected from the boring rods, and connected to a rocker arm for raising and lowering the percussive tool, when the latter is substituted for the rotary boring tool. W. H. T.

IMPROVEMENTS IN AND RELATING TO APPARATUS FOR USE IN SINKING BOREHOLES AND FOR OTHER ENGINEERING OPERATIONS.—E.P. 220,776.

The invention consists of an improved form of device for giving the necessary motion to the operation member. A rotary abutment in the form of a volute, round which the cable passes, imports the reciprocating motion to the cable. W. H. T.

IMPROVED MEANS FOR DRIVING THE SAND REEL IN WELL-DRILLING APPARATUS.—E.P. 221,126.

The invention provides a means whereby the sand reel may be operated by a direct drive from the band wheel shaft. The mechanism is so constructed that the sand spool is in a position in front of the rig on the "walk" side, in order that a straight pull may be exerted on the sand line, thus permitting the line to spool properly on the reel. W. H. T.

GEOLOGICAL

THE NATURAL WEALTH OF PERU. *Oil Engineering and Finance*, July, 1924. G. Howell, F.G.S., M.Inst. P.T.

The author describes the topography of Peru, its boundary disputes, with its neighbours, Chili and Bolivia, and then passes on to consider its petroleum production and possibilities, after a passing comment upon the mineral wealth of the Republic. The main oilfields are the Zorritos at La Cruz, the well-known Lobitos and the Negritos. All these oilfields are in the Tertiary, and situated on the littoral, which is under twenty miles in width, and exhibits no anticlines, though much dislocated by faults. It is noted that forty million barrels of oil have been produced up to the end of 1922 from 1063 wells. Only 15,000 acres have yet been exploited. It is of interest to hear that oil was used by the Incas for

centuries, that in Pizarro's time it was boiled down and converted into pitch, and that Peru has asphalt roads over 200 years old. A map of Peru is given, and a larger scale one of the principal oil region. It is added that besides the "Lobitos Oilfields" (at present the premier company of Peruvian oil enterprise) the Shell Royal Dutch will certainly pursue an intensely progressive programme in this Republic during the next two or three years. J. E. M. H.

Is there Petroleum in Indo-China?—*La Revue Pétrolifère*, Aug. 16.

This question, about so important a French colony, seems to be answered in the negative, according to the researches of M. Viennot (l'Ecole Normale Supérieure, Paris) and Dr. Nomland (Standard Oil Co. of San Francisco). The American geologist states that the Metamorphic character of the Schist complex which was found, precludes any hopes. This refers both to Zen Bay, and the Touraine regions. M. Viennot's mission examined the same areas, coming to a similar conclusion. J. E. M. H.

Oil after Ninety-Six Years.—*Petroleum Age*, July 1st.

Oil was brought in at Burkesville, Cumberland County, Kentucky, ninety-six years ago, and crude oil was obtained during thirty-one years before abandonment of this historic oil-well, the first producing well in the U.S.A. In 1923 a boom arose in this county, and many operators are once more drilling in the field. The Cumberland County "sands" are all of Ordovician age, save the lowermost, which are designated as Cambrian. These are the most ancient rocks producing oil commercially in the whole world. Surface structure is worked on the bottom of the "Chattanooga" black shales of Devonian age—the outcrop of which is easily followed. They average 23 ft. in thickness, and rest upon the "Cincinnatian" series, which are Ordovician. The field is believed to be of large extent. About 40 rigs are drilling in this field—eight wells were drilled at Sulphur Creek, near Peytonsburg, with only one dry well. The Paragon Development Company has built a pipe-line to Glasgow, and operators are told that the entire output can be handled. Several more producing wells will doubtless soon be started in Cumberland County. J. E. M. H.

The Geology of the Sayre Field (W. Oklahoma). *Petroleum Age*, August 1st.

Sayre, Beckham County, is about three miles north of this field. The first well was brought in July, 1922. The present daily production is not great, some 640 barrels from eight wells. The entire field is covered with sand dunes and there are no surface outcrops. The most readily recognised horizon is that of the "Blaine" formation—(Permian). This is encountered at depths between 300 and 600 feet in the wells already drilled. There are gypsum and dolomites outcropping some three miles to the south of "Section 31." Contours based on the top of the Blaine formation, as found in the well logs, show an elongated dome with 100 feet of closure, the axis running about N. 30° E. The production is found in sandy breaks in the "Big Lime" formation at a depth of 2950 feet. The pay sand in "Section 31" starts about 800 feet below the top of this "Line," believed to be conformable with the top of the Blaine formation. The "Big Line" formation is considered as of Permian age. The producing sands are made up of small pieces of lime mingled with sharp angular broken quartz crystals. They are usually quite porous. Wells drilled to any great depth at Sayre encounter granite wash or other

igneous material, sometimes granite itself. The production has always ceased after this. The field is about four miles in length, with no dry holes between any of the producing wells. J. E. M. H.

PETROLEUM IN HOLLAND. Professor Dr. W. Wanstorf. *Petroleum Zeitschrift*, June 10th, 1924.

A few weeks ago, the first news of the occurrence of petroleum in a State boring near Winterswijk, in Holland, appeared, and recently the information has come in that several hundred litres of the oil have been obtained. From the recent Dutch Geological Land Survey it would appear that the oil-bearing beds should have a considerable extension. The State boring at Corle, four kilometres west of Winterswijk, and two older borings near the German frontier prove the presence of the Zechstein salt formation, and the underlying carboniferous group of rocks. Winterswijk lies 15 kilometres north of Bocholt, where borehole evidence was obtained which helps in the investigation from neighbouring German territory. From Ôding and Vreden there extends into Holland an island-like dome of older beds, beneath the massive but unexplored younger formations that here form a plain. In the Corle boring, beneath Diluvium and Tertiary beds, the Bunter sandstone occurs at 70 metres depth, the Zechstein at 490 metres and the carboniferous at 691·1 metres. The bore-hole entered the latter to a depth of 128·4 metres, where a useful coal seam was noted. The Zechstein contains several salt beds, sometimes nitrate of potash and also bituminous oils. A bed of anhydrite, 27 metres thick, at the base of this formation, yields fluid oil. The oil is still more strikingly proved to be present in the carboniferous beds beneath. It is here held in sandstone and from a coarse bed (1066 to 1083 metres) it flows out as a green fluid. The Corle borehold has proved petroleum in the Zechstein anhydrite and carboniferous sandstones. Whether this will be workable remains to be proved, but important geological conclusions may be drawn from the occurrence of the oil here. The oil from the carboniferous sandstone is clearly oil of migration; probably it has originated to the south of Winterswijk, where the ancient members lie deeper. The oil-bearing zone should be large, more than a kilometre in width and starting from the parent rock or source of the oil. The Zechstein oil is considered by the author to be less important; this oil, he thinks, was formed *in situ*. He remarks that further development of researches here will be followed with special interest in Germany, as the north-western regions of Germany yield other indications, like the above, pointing to the presence of petroleum. J. E. M. H.

SPECIAL REPORT OF THE GEOLOGICAL SURVEY OF CHINA No. 1, JUNE, 1921. *Petroleum*, 12, p. 341.

The decision of the Standard Oil Company to stop work at Shensi after spending about 3 million dollars, has caused great disappointment. The prospecting work was confined to the North part of Shensi, and the number of holes put down were by no means sufficient. Altogether seven holes were put down in the districts of Yench'ang, Fussi, and Chungpu. The oil flow was found to be insufficient. In Yench'ang, however, the Government wells have been producing steadily for a number of years. The oil-bearing formation in Shensi extends northwards until it reaches Turkestan. Oil is also known to occur in salt wells south of the Chinling mountain in the red basin of Szechuan, where are situated numerous anticlines. W. H. T.

DIE STAATLICHEN NAPHTHAGRUBEN VON GBELY IN DER SLOWAKEI. Dr. Edward Schnabel Göding. *Petroleum Zeitschrift*, June, 1924.

The Gbely and Göding anticlines are in the south Moravian Plain, in the district of the March tributary of the Danube. Before the war, this area was exploited by the Hungarian Government, but since the re-arrangement of territories, the Czecho-Slovakian Government has carried on the work. This paper gives a very detailed description of the stratified rocks of the plain. After noting the dunes and loess followed by sand-dunes, some sandstones are noted derived from subjacent Oligocene and Eocene formations. Toward the centre of this sandstone area, two metres of siliceous marl replace the sand-dunes above, and when these are disturbed, both gas and oil appear, as shown by superficial borings at Göding. Beneath these rocks (Quaternary) the Neocene formations are found. The *Upper Pontian* are lacustrine and fresh-water sediments with various species of *Congeria*, fossil remains of which are common in the bricks of Gbely and the Arlbery tunnel. The *Lower Pontian* are termed the Bcienger sands or *Melanopsis* beds. These are water-bearing sands, and no oil layers are found in them. The Pontian beds vary widely in thickness (10–170) metres in the anticlinal districts as hitherto explored. The next beds that follow unconfirmably are the Sarmatian. They differ characteristically from the Pontian by containing much lime, glauconite, pyrites, and foraminifera, with shells such as Tellina, Mactra, etc. At Gbely, they form a complex of clay and marls, from 140 to 160 metres thick. The overlying beds are quite independent, both palæontologically and tectonically. Carburetted hydrogen makes its first appearance in the middle Sarmatian beds shut in by the marls and clays of the upper Sarmatian. The anticline has been worked out in the Sarmatian beds. The upper oil accumulations are at a depth of from 136–180 metres. The plain sinks to the east towards the Gbelo syncline where water occurs. The lower Sarmatian oil-bearing sands are at a depth of 213–256 metres. Following, then come blue grey marls for 25 metres, and then the lagoon and shore deposits of the Mediterranean (second stage) beneath which occur true loams of the first stage. Opinions differ as to the source of the oil; many authorities consider it as of secondary origin, others of primary. Further researches by the State are recommended. A section across the Gbely oilfield is given, and a geological map of the area. Many detailed analyses of the products from the bore-hole are given, together with the physical properties of the oils obtained. J. E. M. H.

CALIFORNIA OILFIELD WATERS. Chase Palmer. *Econ. Geol.* **19**, 623.

The article disputes the accepted explanation of the origin of the alkaline sulphide and carbonate waters of oilfields, and advances a new hypothesis.

The current view, originating with von Höfer, is that sulphate waters, resulting from the leaching of sulphate deposits and the oxidation products of organic sulphur compounds and sulphides by meteoric waters, meet with hydrocarbons, whereby the sulphates are reduced to sulphides and converted to carbonates with the formation of carbon dioxide and water. The reaction progressively increases the content of carbonate at the expense of sulphide. The zone of strong sulphur water, often found between the normal sulphate ground waters and the alkaline carbonate waters, is regarded as a transition stage.

No experimental evidence exists that it is possible for sulphates to

be reduced to sulphides under the conditions of an oilfield. The reaction is endothermic, and the reduction of sodium sulphate by carbon in the Le Blanc soda process requires a temperature of 1000° C.

Investigation of the oilfield water conditions at Huntingdon Beach shows that the "corrosiveness" of the oilfield brines decreases with depth owing to the increasing neutralising effect of alkaline carbonates, and suggests that the carbonate waters have a deep-seated source. In the same field, sulphur waters in contact with tar sands, about 2000 ft. below sea level, cannot be transitional between sulphate ground waters and alkali carbonate waters, since the ground water contains no sulphate.

Organic sulphur compounds are common constituents of petroleum; and a common by-product of reactions involving such compounds, especially in slightly acid solutions such as brines, is the gas, carbon oxysulphide. This gas, which reacts readily with alkaline solutions to form alkaline sulphides and carbonates, has actually been found naturally associated with sulphur springs and bitumen.

The hypothesis is advanced, therefore, that alkaline carbonate waters are primarily the result of interaction between sedimentary waters and the containing rock material, particularly where this is granitic; that by interaction between sedimentary waters and the organic sulphur compounds of oil, carbon oxysulphide is evolved; and that this gas, reacting with the alkaline waters, gives rise to the alkaline sulphide waters. W. G. W.

Distillation and Refining.

Refining without Shut-down for Rerun. G. W. Reid. *Ref. and Nat. Gas. Mfr.*, 1924, **3**, 27.

In refineries not equipped with special still for rerunning distillates that are not up to specification, the most efficient system consists in spraying the distillate into the top of the fractional condensing towers on the crude stills. The distillate falling counter current to the ascending vapours is stripped of its lightest constituents whilst the heavier portion back-traps into the still and is vapourised on reaching the still held at its particular vapourising temperature. In this way shutting down crude stills in order to rerun the distillate is avoided. Bubble towers are advocated as giving an increased fractionating efficiency and obviating the necessity of having to rerun distillates. F. G. P. R.

Automatic Temperature Control in Fractionating Towers. W. C. Begeebing. *Nat. Petr. News*, 1924, **16**, 67.

The present-day method of grading light petroleum products on the basis of final boiling point has rendered necessary a very strict control of temperatures in fractionating columns or dephlegmators. Great strides have lately been made in the construction and efficiency of these towers, but whatever the form the final controlling factor in their operation is the temperature of the vapours leaving the column. Under cooling or over cooling of the towers produces distillates containing too much or too little heavy ends, and therefore the required degree of cooling is best regulated by utilising the desired temperature of the vapours at the exit as a thermostatic control. Three means of cooling can be employed—oil, water, air or a combination of these three. Oil is used by spraying the cold feed oil for the still into the top part of a bubble tower or by circulating it in a closed coil within the tower. Water can only be employed in a closed coil, whilst air—though seldom

used now on account of sudden uncontrollable meteorological changes—must pass through internal flues. All these means of cooling can be controlled by regulating the quantity of cooling liquid passing through the system, which is brought about by motor actuated valves operated by temperature indicators in the vapour line from the tower. These require setting to accord with the nature of the oil being distilled, the firing temperature of the still, etc., and although they cannot entirely eliminate the human factor, they enable more consistent results to be obtained in cutting to a desired end point. F. G. P. R.

Towers Improve Accuracy of Fractionation. H. Pennington. *Ref. and Nat. Gas. Mfr.*, 1924, **3**, 15.

Almost any kind of tower improves the accuracy of fractionation since it acts as an atmospheric partial condenser. Many towers combine dephlegmation with partial condensation, but their structure must vary depending on whether the condensate is to be returned with the dephlegmated oil to the still or trapped and taken off as a finished cut. To obtain good dephlegmation the direction of the vapour stream must be abruptly changed and at the same time its velocity reduced in order to bring about deposition of entrained oil fog. The author describes a dephlegmator of his own design in which a cone shaped hood over the vapour exit from the still is situated within a larger bottle shaped vessel, through the bottom of which passes the still vapour-exit pipe. A run-back pipe from the bottom of the bottle maintains a certain depth of dephlegmated oil in this vessel. The still vapours therefore impinge first on the metal cone, reverse direction and impinge on the liquid surface and then enter the larger area of the bottle where velocity is reduced. As condensation of vapours is not required dephlegmators should be lagged. Eight types of fractional condensation towers are described, which include those fitted with various types of baffle plates, ring packing, pan baffles, bubble devices, coil coolers and spray coolers. Condensation takes place chiefly on the walls of the towers, the vapour in the centre being at a higher temperature. Therefore the vapours issuing from the tower will always contain some having an end point which is too high, whilst the condensed portion will contain light fractions that should have passed out of the tower. The bubble tower and baffle pan systems promote refractionation of the descending streams of condensate by the ascending hot vapours, and thus act more effectively than the plain baffle and deflector types. In all such towers, however, variations of atmospheric conditions produce changes in the degree of condensation taking place. It is therefore impossible to maintain production of a uniform product from such towers even during the course of 24 hours. Connecting up several towers in series will assist in maintaining a closer cut, but will not give perfect uniformity. Reduction in the diameter of the towers gives more uniform cooling as there is less difference in temperature between the centre and outside vapours. The Gray tower is on the design of a vertical water tube boiler in which air circulation in the fire space is induced by natural draught through bottom and top ventilators. The outside tubes, however, are better cooled than the centre ones. To overcome this the author has designed a tower in which the boiler tubes are replaced by flat narrow boxes which give two large cooling surfaces in close proximity. The headers are placed at the side so that air can pass uniformly up between the cooling surfaces. The whole is encased in an insulating vessel at the top of which are dampers controlled by thermo-regulators actuated by the temperature of the vapours issuing from the tower.

The amount of air circulating through the system, and consequently the cooling effect is varied by movement of the dampers and thus the temperature of the issuing vapours can be controlled between fixed limits. The author considers that the products from pressure cracking plants could be fractionally condensed in this manner and thus do away with the necessity of first condensing and then redistilling the light portions. F. G. P. R.

USE OF HYPOCHLORITE SOLUTION FINDS FAVOUR. Lincoln T. Bradley. *The Refiner*, July, 1924.

The process referred to is the refining of petroleum distillates by the hypochlorite method, and has been found to be particularly efficient for the refining of Persian crudes. The process developed and patented by the Anglo-Persian Oil Company is one that shows many marked advantages over the acid and soda treatment. The solution of calcium hypochlorite is made from liquid chlorine and slaked lime. Mechanically it is easier to handle than acid and does not leave a residual sludge. The process produces a gasoline of higher quality at a lower operating cost, and very few plant modifications are necessitated by the replacement of acid by the hypochlorite treatment. The process carried out is as follows :—

(1) Preliminary soda wash (3 per cent. of 10 per cent. solution). This preliminary treatment improves the odour of the distillate and removes some of the colour.

(2) Water wash to remove traces of soda solution.

(3) Wash with hypochlorite solution. The proportion required varies with the strength of the solution used, the average composition of the distillate and the degree of refining necessary. For straight run distillates, the strength of the solution can vary between 20 and 30 grammes per litre of available chlorine, while for cracked distillates better results are obtained with weaker solutions.

(4) Second water wash.

(5) Second soda wash.

(6) Final water wash.

Both continuous and batch methods of treatment can be carried out. It is stated that the hypochlorite process improves the odour of distillates and removes those compounds which develop colour and bad odour while gasoline and kerosene are in storage. The process is available for all types of crude oils and may be used, either for complete desulphurisation or for refining oils sufficiently to pass the usual tests. It is known that treatment of cracked gasoline with acid produces a spirit which, on redistillation, causes corrosion of stills and condensors. This trouble, together with that of excessive loss during treatment, is obviated by the use of hypochlorite. W. H. T.

CALIFORNIA DEVELOPMENT IN THE PREPARATION AND USE OF ADSORBTIVE CLAYS IN REFINING. Carl J. von Bibra. *The Refiner*, July, 1924.

The theory of the refining action of clays such as fuller's earth is that of "Adsorbtion" as defined by Gurwitsch and Freundlich. This, as is well known, deals with the concentration of the solute in the free surface layer of a solution and the subsequent adsorbtion of the solute by the surface, pores and capillary spaces of a solid body introduced into the solution. The impurities in the oil to be refined can be regarded as the solute, the solid body which removes them being the clay brought

into contact with the oil. Microscopic examination of an adsorbtive clay reveals the fact that the constituent particles possess a very delicate micro-structure. Crystalline material even in a very finely divided state has practically no adsorbtive power and shows no micro-structure.

Fuller's earth has been used extensively as a refining medium, but has the following disadvantages :—

(1) Large quantity required to obtain commercial results ;

(2) Large quantity of oil held in the clay after treatment ;

(3) High cost of transport to refining centres. In view of these drawbacks, various local deposits of clay in the neighbourhood of refineries have been tested and used for refining purposes. Some of these clays, when treated with dilute mineral acid, have an efficiency of as much as 20 times that of fuller's earth. Three extensive deposits of colloidal clay occur in California. These are all uniform in character. One, Montmorillonite, is not a true clay, but rather a volcanic ash laid down under marine conditions. Montmorillonite is a dense and relatively hard mineral with a soapy feel and wax-like consistency. It contains approximately 50 per cent. of water, and on drying has the appearance of decomposed granite. The mineral has been mined by open cutting and by tunnelling. Halloysite is a similar mineral formed by different means but occurring in smaller deposits.

Methods of treating clays vary according to the type of oil to be treated. Frequently, the dried clay is ground to about 100 mesh, fed into a 25% solution of H_2SO_4 and "cooked" with steam. The treated clay is then washed free from soluble salts with successive amounts of hot and cold water. A patented process deals with the use of treated clay in the form of a thin mud. The mud is mixed with the oil, emulsified, and dehydrated in a tube furnace, adsorption by the clay taking place during dehydration. A further method is to remove the water from the clay by passing the mud over a leaf filter, the resulting cake being dried and ground to about 200 mesh, when the clay is ready for use. Spent clay can be recovered be several processes, but the recovered clay, however, has not the high adsorptive power of the fresh material. Elaborate solvent processes have been used, but are far too expensive for economic working. The simplest method is to burn the spent clay filter cake under boilers or stills. The mining of colloidal clays is the latest development in the Pacific Coast fields. These clays when treated with acid produce a very efficient filtering medium, which is far cheaper than artificial products, such as "Silica Gel." The use of clay unfortunately involves the remodelling of refining plant, but results indicate that this is not an insurmountable difficulty. W. H. T.

PROCESS OF DISTILLING OIL.—J. J. Allinson, Assr. to Doherty Research Co. U.S.P. 1,500,040–10 of July 1, 1924. (Appl. July 17, 1919.)

Heated oil is passed through compartments maintained under a partial vacuum. The oil enters the chambers in a finely divided state. The vapours drawn from the chambers are condensed. The residuum from the vacuum stills is passed through a heat interchanger to preheat incoming oil. T. A. S.

IMPROVEMENTS RELATING TO THE FRACTIONAL DISTILLATION OF PETROLEUM AND SIMILAR HYDROCARBONS. Brunn-Konigsfelder. Maschinen Fabrik and K. Fuchs. E.P. 196,624 of April 21, 1923. (Convention (Germany), April 22, 1922.)

Oil is passed down a tower consisting of a number of chambers containing heating tubes through which steam is passed. Means are also provided for the admission of live steam into each chamber. Oil entering at the top of the tower flows on to the heating tubes in the top chamber, and after passing through a trap falls on to the tubes in the second chamber. This operation is repeated down the tower. Vapours are withdrawn from each chamber and are condensed. Waste heat from the distilling column is used to preheat the incoming oil. High output with low construction cost is claimed. T. A. S.

Apparatus for Condensing and Fractionating Hydrocarbons. E. Owen. U.S.P. 1,505,798 of Aug. 19, 1924. (Appl. Dec. 14, 1920.)

Vapours from a still are delivered to the first of a series of rectifying columns, each of which is surmounted by a water condenser. New oil is passed in the opposite direction through the rectifying columns, which act as heat exchangers. Condensates are taken from each unit, the character of the condensate being governed by the flow of cooling water through its respective condenser. T. A. S.

Apparatus for Distillation of Mineral Oils.—E. E. Billow, Assr. to A. M. Allen. U.S.P. 1,507,659 of Sept. 9, 1924. (Appl. May 29, 1918.)

A tower, closed at the top except for a vapour off-take, stands in a vessel containing molten lead. Oil, which is first preheated by passing through pipes submerged in the molten lead, is sprayed downwardly through nozzles situated in the top of the tower. Arrangements are provided for the nozzles to be changed without admitting air to the apparatus. T. A. S.

Treating Petroleum Oils.—Assrs. to the Standard Oil Co., R. N. Donaldson and R. McCollum. U.S.P. 1,506,115 of Aug. 26, 1924. (Appl. March 21, 1923.)

The invention relates to the treatment of crude oil for the removal of colloidal asphaltic matter and separation of water emulsions. These emulsions are often difficult to break, on account of the presence of petroleum soaps and colloidal asphalt. On treatment, however, with dilute sulphuric acid the soap bodies are decomposed and the colloidal asphalt flocculated, and after filtration the oil and water separate readily. The treatment is carried out by mixing the oil and acid (·05 to ·75 per cent. of 10 per cent. H_2SO_4) in a vessel containing baffle plates, passing then to a heater maintained at a temperature of 100° to 200° F. This temperature, depending on the nature of the oil, is sufficient to decompose the emulsifying bodies which are subsequently removed by an ordinary filter press, the plates of which are covered with canvas. Before filtering the canvas is covered with a deposit of diatomaceous earth 1-16th in. to ¼ in. thick by pumping a mixture of the earth and oil free from water and colloidal asphalt through the press. After filtration the oil passes to a settler and the water and excess acid separates into two layers. S. B.

Process of Purifying Light Hydrocarbons.—F. H. Smith and G. J. Zirer. Assr. to Standard Oil Co. U.S.P. 1,507,692 of Sept. 9, 1924. (Appl. July 21, 1922.)

Light hydrocarbons, containing colour-producing bodies, are aged until they attain maximum colour. The colour is then removed by absorptive material. T. A. S.

PROCESS OF TREATING HYDROCARBONS.—H. H. Culmer. U.S.P. 1,505,870 of Aug. 19, 1924. (Appl. April 4, 1919.)

The viscosity of hydrocarbon oil is lowered by spraying it on a bed of incandescent coke contained in a closed externally heated retort. The temperature of the coke is regulated to prevent the formation of a large quantity of uncondensable gas. T. A. S.

PROCESS OF PURIFYING MINERAL OIL.—E. Petty. Assr. to De Laval Separator Co. U.S.P. 1,500,202 of July 8, 1924. (Appl. Aug. 24, 1921.)

An emulsion of mineral oil is passed, along with a small quantity of treating agent, through a permeable mass whereby an intimate mixing of the treating agent with the emulsion is obtained. The resulting mixture is passed through a centrifugal, the oil being separated from the contaminating liquid. T. A. S.

TREATING PETROLEUM OILS.—R. N. Donaldson and R. McCollum, Assrs. to Standard Oil Co. U.S.P. 1,506,115 of Aug. 26, 1924. (Appl. March 21, 1923.)

Crude oil is treated with sulphuric acid to flocculate its asphalt content without sulphonating the oil. The flocculated bodies are removed. T. A. S.

CRACKING AND HYDROGENATION.

PURIFYING AND DEODORISING ISO-PROPYL ALCOHOL.—H. E. Buc. U.S.P. 1,498,229 of June 17, 1924. (Appl. Jan. 18, 1923.)

*Iso*propyl alcohol, prepared from the gases produced during the cracking of oil, can be purified and deodorised by treatment with small amounts of sodium or calcium hypochlorite solution containing free alkali. The alcohol is distilled off after thirty minutes. S. F. B.

DISTILLATION WITH ALUMINIUM CHLORIDE.—A. M. McAfee, Assr. to Gulf Refining Co. U.S.P. 1,501,014 of July 8, 1924. (Appl. March 29, 1922.)

A vertically downward flowing column of oil is passed through a zone of increasing temperature. Aluminium chloride is supplied at a mid-point, the vapours passing upwards through the oil. T. A. S.

PROCESS FOR THE CONVERSION AND TRANSFORMATION OF OILS.—J. H. Adams, Assr. to The Texas Co. U.S.P. 1,506,877–8 of Sept. 2, 1924. (Appl. March 3, 1919.)

Oil is heated by means of electrical units in a combined vaporising and cracking chamber. One unit is immersed in the oil to bring about vaporisation, another unit being in the vapour space above. The apparatus is surmounted by a dephlegmator device which separates heavy fractions and returns them to the cracking chamber. The lighter fractions are removed. The apparatus is maintained at superatmospheric pressure. T. A. S.

PROCESS OF REFINING OIL.—D. Pyzel. U.S.P. 1,506,444 of Aug. 26, 1924. (Appl. May 18, 1921.)

A body of oil is maintained at cracking temperature and light vapours formed are continuously removed. Oil is also continuously removed to

prevent the accumulation of carbon. New oil to replace that distilled off or otherwise removed is continuously added. The impure oil withdrawn is continuously distilled with steam. T. A. S.

APPARATUS FOR TREATING OILS.—R. E. Pollock, Assr. to Universal Oil Products Co. U.S.P. 1,509,819 of Sept. 23, 1924. (Appl. June 25, 1924.)

Oil is heated to cracking temperature in a tube and expanded into a large insulated vessel fitted with a vapour off-take and a plurality of residue draw-off lines situated at different vertical positions. A carbo discharge is fitted at the bottom of the expansion chamber. T. A. S.

APPARATUS FOR CRACKING AND REFINING OIL.—E. A. Reilly and R. M. McLain. U.S.P. 1,501,371 of July 15, 1924. (Appl. Oct. 19, 1921.)

Oil is heated in a conduit, part of which is exterior and part interior to a still. In the still the oil in the conduit heats a large body of oil above the surface of which the oil is sprayed on leaving the conduit. T. A. S.

IMPROVEMENTS RELATING TO CRACKING OF OILS.—V. L. Oil Processes Co. and O. D. Lucas. E.P. 219,403.

Oil is distilled and the vapours, carried by inert gas containing ammonia, are passed into a cracking retort. The ammonia is passed directly into the retort and not into the still. 100 gallons of oil requires 500 cu. ft. of carried gas and 10 cu. ft. of ammonia, with or without a small quantity of hydrogen. The inert gas may be steam or gases produced in cracking. The retort contains a catalyst. T. A. S.

IMPROVEMENTS RELATING TO CRACKING OF OILS.—V. L. Oil Processes, Ltd., O. D. Lucas, and E. L. Lomax. E.P. 219,404 of April 26, 1923.

Oil is heated under pressure, to a temperature higher than the boiling point of the heaviest fraction, by passing it through a tube placed in a furnace. It is then expanded into a cracking retort, the whole of the oil being instantly vaporised. At the moment of expansion inert gas, from the cracking operation, and containing a little hydrogen or ammonia, or both, is admitted. The cracking retort is maintained at 550° C. to prevent any condensation, and also contains a catalyst. The process is not suitable for oils which crack in the liquid phase during the initial heating. T. A. S.

PROCESS AND APPARATUS FOR OBTAINING VALUABLE HYDROCARBONS FROM MATERIAL OF INFERIOR VALUE.—G. Linnmann. E.P. 214,940 of Aug. 24, 1923. (Convention (Germany), April 24, 1923.)

Hydrogen, obtained by passing steam over heated iron turnings, is passed through a vertical retort containing brown coal or similar material. The products are passed directly through a filtering tower to condensers and gas storage or may be passed through a retort containing more iron turnings. In the latter case from 25 kg. of brown coal, 20 kg. of heavy benzine, .5 kg. carbon, and 5 cu. metres of gas can be obtained. If the treatment of the mixed vapours with iron turnings be omitted, 10 kg. of heavy benzine, 15 cu. metres of gas, and 3 kg. of carbon residue are obtained. T. A. S.

IMPROVEMENTS RELATING TO THE CRACKING OF HYDROCARBON OILS AND THE TREATMENT OF SOLID CARBONACEOUS SUBSTANCES.—Thomas Malcolm Davidson and George Pearce Lewis. Brit. Pat. No. 220,732, Aug., 1924.

The hydrocarbon is treated in a stream of molten metal such as tin, which is maintained in circulation in a downward direction in the middle of the retort and in an upward direction near the wall of the retort, the hydrocarbon being introduced so that it is carried up with the ascending stream of metal. For this purpose a concentric tube forms the outer wall of the retort, and an annular space up which the molten metal circulates. The inner tube extends upwardly short of the extreme length of the outer tube, and the molten metal fills the retort to a position above the level of the inner tube. A supply pipe connected to the bottom, periodically or continuously, introduces the oil into the annular space. Slots at the lower end of the inner tube allow the metal to circulate into the annular cracking space and carry the oil upward. The cracked oil or substance rises above the level of the molten metal, and is discharged through an outlet, at the top of the cracking tube. The process is worked at about 400° C., and 600 lbs. pressure. These conditions, however, may be modified according to the extent of cracking required or according to the hydrocarbon to be treated. R. P.

IMPROVEMENTS RELATING TO THE TREATMENT OF LIQUID HYDROCARBONS.—Samuel James Manson Auld, Albert Ernest Dunstan, and Percy Henry Herring. Brit. Pat. 220,664.

The invention relates to the cracking of liquid hydrocarbons, and is of especial utility in the treatment of heavy asphaltic residues for the production of a proportion of light spirit and rendering the ultimate residue after removal of the light spirit, less viscous and more suitable as a fuel oil. The process is a liquid phase process and consists of three separate heating zones: (1) a preheating zone in which the oil is heated to a temperature of about 25° C. below its determined cracking temperature; (2) a thermolysing zone where the oil is gradually and uniformly heated to a temperature about 20° C. above its mean cracking temperature, and (3) a reactor zone in which the oil is maintained for a definite period at its mean cracking temperature. In the first stage the oil is passed through a preheating tube of sufficient length to raise the oil to the required temperature; in the second stage the oil stream is divided into a number of short parallel thermolysing tubes which are gradually and uniformly heated to a temperature about 20° C. beyond the mean cracking temperature of the reactor. The temperature is carefully controlled to avoid overheating of these tubes. In this manner the interval between the acquisition of cracking temperature and the consequent reaction is prolonged sufficiently to prevent premature deposition of carbon in these tubes. From the thermalyser tubes the oil passes to the third heating-zone, a reaction vessel, wherein the temperature is maintained at the determined cracking temperature until the reaction is complete. This vessel is of suitable dimensions to contain all the carbon formed in the process. A pressure of 350 to 450 lbs. is maintained throughout the process, which is continuous, to keep the gases and vapours dissolved until the oil passes through a relief valve into the gas separator. The invention has among its objects, to avoid secondary reactions in the vapour phase, to reduce the amount of uncondensable gas, to secure light products of good quality and to restrict the quantity of spirit, whereby the vapours and gases remain dissolved in the treated

residue, which is maintained as a fluid in which part of the carbon is carried away, while the carbon deposited is relatively small in quantity and is not deposited in the tubes where it would hinder the operation, but is exclusively deposited in the "reactor." R. P.

IMPROVEMENTS IN AND RELATING TO THE CRACKING OR DECOMPOSITION OF MATERIALS CONTAINING OR YIELDING HYDROCARBONS.—Dr. Michael Melamid. Brit. Pat. No. 221,559.

Tars, crude petroleum, coal or like highly complex materials, in a finely divided condition, are subjected, at a high temperature in the presence of a protective gas, to the action of catalytic materials which will not yield carbides and which are liquefied at the temperatures employed. For instance, producer tar from lignite or coal is liquefied by heat and introduced into the apparatus by means of nozzles, which produce a very fine spray, in the presence of a protective gas and a liquid alloy. In the few moments of contact between the fog-like mixture and the contact material at a high temperature, the first part of the reaction takes place. The mixture is then submitted to further similar treatment in a series of reaction chambers similar to the first until the required degree of cracking is attained. The protective gas may contain hydrogen or any gas which is adapted to prevent dehydrogenation. R. P.

PROCESS OF PRESSURE DISTILLATION.—Robert J. Black. U.S. Pat. 1,510,918.

The process is for the purpose of cracking heavy hydrocarbons. The non-condensible gas produced in pressure still cracking, is returned to the still through perforated pipes placed on the bottom of the still where the oil is in direct contact with the highly heated wall, and where cracking of the oil largely takes place. The fixed gases, containing a large percentage of hydrogen, are thus injected into the oil under pressure, supplying the nascent unsaturated hydrocarbons with hydrogen, so that a large proportion of saturated compounds are formed. A preferred form of apparatus is shown but it may be applied to practically all existing shell-type pressure stills. It is advantageous to introduce gases rich in hydrogen, in addition to the fixed gases produced in the process.

R. P.

CATALYTIC DECOMPOSITION OF HEXAHYDRO-AROMATIC AND SATURATED ALIPHATIC HYDROCARBONS. THE CRACKING OF PETROLEUM.—V. Grignard and R. Stratford. *Comp. rend.* 1924, **178**, 2149–2152.

The catalytic effect of aluminium chloride in the thermal decomposition of hydrocarbons ("cracking") has been studied at temperatures varying between 120° and 150°. The proportion of the catalyst used was 20–30 per cent. It was found that, whereas *cyclo*-hexane and methyl*cyclo*hexane remain unaffected, *o*-dimethyl- and to a smaller extent *p*-dimethyl*cyclo*hexane were converted into the *m*-derivatives. Hydrocarbons having a side-chain of two or three carbon atoms, whether straight or branched, cracked to give 1–5 per cent. of a product containing a saturated aliphatic hydrocarbon, together with polymerised *cyclo*hexanes and polymethyl*cyclo*hexanes in which the methyl groups are *meta* to each other. The three butyl*cyclo*hexanes were cracked to the extent of 13–15 per cent, *n*-butane being formed from the normal and secondary, and a mixture of butanes from the tertiary compound. The uncracked portion was found to contain tetramethyl*cyclo*hexanes. Amyl- and isoamyl*cyclo*hexanes are decomposed to the extent of 70 per cent. and 42 per cent. respectively, into methyl*cyclo*hexane and *n*-butane, tetra- and

penta-methyl*cyclo*hexanes being formed at the same time by isomerisation. Several open-chain hydrocarbons containing from eight to seventeen were also examined and it was found that all gave *n*-butane, the longer chains breaking at both ends simultaneously. S. F. B.

PYROGENETIC FORMATION OF AROMATIC HYDROCARBONS FROM PARAFFIN WAX.—B. Kabelac. *Eleventh Report Fuel Tech. Inst. Czech. Polytech. Highschool, Prague*, 1922–1923, 86–88.

Purified paraffin wax from Borsylav crude oil was boiled and the vapour mixed with carbon dioxide passed through a porcelain tube heated to 600°, 800° and 1000° respectively, in three series of experiments. At 600°, 60 per cent. of the wax was converted to gases and 36 per cent. recovered as a yellow mobile oil, specific gravity 0.770 with a paraffin content of 18.8 per cent. The iodine value was 95.5 (Hanus). No aromatic hydrocarbons could be found. At 800°, only 18 per cent. was recovered as a dark mobile oil, containing much asphalt and resin. It had specific gravity 0·910, paraffin content 1.57 per cent., and iodine value, 103 (Hanus). At 1000° nothing but carbon could be isolated. S. F. B.

DETERMINATION OF OLEFINS IN GASES.—H. Suida and A. Weseley. *A. anal. Chem.* 1924, **64**, 143.

In the examination of gases obtained from cracking processes difficulty is experienced in getting a constant volume absorbed by bromine or fuming sulphuric acid due to the fact that these regnents react slowly with other hydrocarbons present. If bromine water of .04 per cent. concentration be used and the gas diluted with air a constant residual volume can be obtained after 6–8 mins. shaking. S. B.

STUDIES IN PYROGENIC DECOMPOSITION OF NAPHTHA OIL.—II.—K. Smolenski and others. *Przemyol Chem.* **6**, 250–273, 281–312.

Various Polish aromatic base petroleums have been examined with a view to ascertaining the yields of aromatics, the high distillation temperature method being used. It was found that gas oils gave the greatest yields with benzene, 9 per cent., toluene, 3 per cent., and xylene, 1 per cent. Benzine proved to be a poor source. It gave chiefly carbon and gases at 700–720°, and 10.3 per cent. of impure aromatics at 650–700°. Naphtha gave 12 per cent. of good aromatic hydrocarbons at 650–670°, 4.1 per cent. of this being toluene and 2.7 per cent. xylene. S. F. B.

CATALYTIC DECOMPOSITION OF PETROLEUM OILS UNDER THE INFLUENCE OF ALUMINIUM CHLORIDE.—N. D. Zelenskii. *Techn.-Wirschaftl. Nachr.* 1922, 193–197.

When heavy petroleum oils such as solar oil are heated at 470–500° in the presence of activated charcoal, a fraction b.p. 35–150° is obtained in 38 per cent. yield, which contains both aromatics and unsaturated substances. Aluminium chloride between 150° and 250° gives similar products, as well as a small amount of gas. The liquid portion closely resembles benzine and can be obtained in 61 per cent. yield by repeated cooling to 180°, followed by reheating. The hydrogen content is higher than that usually found in cracked substances. Vaseline, machine oil and paraffin oil give similar products. S. F. B.

CATALYTIC TREATMENT OF CRACKED DISTILLATES IN THE VAPOUR PHASE.—T. T. Gray and M. R. Mandlebaum. *Ind. and Eng. Chem.* **16**, 913.

The odour, colour and stability of cracked distillates are improved when the vapours are passed through heated fuller's earth or similar materials, due to polymerisation of the more unstable constituents. Diolefins or similar compounds occurring in quantities of less than 1 per cent. are believed to be the cause of the objectionable properties of cracked oil, and by the treatment these compounds are removed. Burton still distillate treated by this process showed a polymerisation loss of 0.7 per cent., and the distillate obtained seemed in every respect equal to straight run gasoline. One ton of earth was used to treat 200 barrels of distillate. The polymerised product seems to be composed of at least two types of compound, one a viscous coloured liquid, another a semi-solid tacky mass, and both have high iodine numbers. The liquid compound is distillable at low-pressure and seems to correspond to high-grade lubricating oil. The possibility of vapour phase polymerisation as a source of lubricating oils is indicated. R. P.

PETROLEUM CRACKING AND FUTURE PRODUCTION PROBLEMS.—T. A. Boyd. *Ind. and Eng. Chem.* **16**, 1004.

The cracking of heavy oils for gasoline is considered to be the most outstanding development in the petroleum industry during the past decade. In 1913 America produced 1100 million gallons, equal to 12½ per cent. of crude refined. Ten years later the volume of gasoline amounted to 7500 million gallons, equal to 30 per cent. of the crude oil distilled. Much of the increase is due to cracking and the capacity of cracking plant in the United States is estimated to be sufficient to produce twice the total of all gasoline produced in 1913. In a recent survey of 563 refineries, 164 were equipped with one or more cracking processes, and while 201 or 35 per cent. of all refineries were shut down on May 1, 1923, only 10 per cent. of those fitted with cracking plant were not operating. Under present conditions it seems imperative that the highest possible yield of gasoline be obtained from the crude oil. There are about 40 cracking processes now in use commercially, but many of these are the same in principle. One of the most important modifications of the past few years has been the change in design of cracking plant in order to keep the main body of oil away from the source of heat, and reduce the danger which attends the subjection of a highly inflammable liquid to a high temperature. This is usually obtained by using tubes in the high temperature zone, and pumping the oil at a high velocity through these tubes. Higher pressure is more general, in order to maintain the liquid phase with a consequent saving in fuel and a reduction in loss. Progress in the past has been more on physical and engineering lines, and the chemical knowledge of cracking remains a field for research. Although petroleum refining in the past has been largely physical in character, it is rapidly becoming a chemical industry and the part of the industry which has changed from physical to chemical is centred round cracking. As a result of the active entrance of the chemist into this industry, many materials can now be made from the by-products of the cracking plant. For some time iso-propyl alcohol has been manufactured commercially, and many other materials have been made such as ethylene, propylene, secondary butyl, amyl, hexyl, heptyl, octyl alcohol, ethyl ether, ethylene chlorhydrin, ethylene glycol, ethylene dybromide, oxalic acid, formaldehyde, and formic acid, acetone, and other materials. Marked progress

has been made during the last few years in improving old methods and in working out new processes. Needless to say, too little is known about the chemistry of cracking; most of the work in cracking has been done in an empirical way, with little knowledge of the chemical reactions taking place or the composition of the raw material. There is, therefore, a wide field for research, but not an easy one, as is evident from the small amount of progress which has been made so far, in spite of the fact that much endeavour has been concentrated on it, but it is of great scientific interest and practical importance, and holds out the possibility of large reward to the successful investigator. A few of the problems which await solution are mentioned, followed by a list of commercial cracking processes in use in the United States at May 1, 1924. R. P.

REVERSIBLE CATALYSIS OF UNSATURATED HYDROCARBONS.—I. N. Zelinsky and G. Pavlov. (*Ber.*, 1924, **57** (B), 1066–1070.)

The dehydrogenation of *cyclo*hexane under the influence of palladianised asbestos has been examined between 160° and 320°. At 164° it is perceptible and the products of the action consist of benzene and *cyclo*hexane, no *cyclo*hexane remaining unchanged. In the absence of palladium, *cyclo*hexane remains unaffected at 200°. *Cyclo*hexadiene behaves in a similar manner. At 140°, 1:4 dimethyl*cyclo*hexane gives rise to xylene and dimethyl*cyclo*hexane; Δ^1 dihydronaphthalene similarly yields naphthalene and tetrahydronaphthalene at 130°. This reversible catalysis appears to be characteristic of cyclic hydrocarbons having a double bond in the ring, but not when the bond is present in a side chain. S. F. B.

CATALYTIC HYDROGENATION OF ORGANIC COMPOUNDS WITH COMMON METALS AT THE TEMPERATURE OF THE LABORATORY. VI.—INFLUENCE OF OXYGEN ON NICKEL CATALYSTS AT ELEVATED TEMPERATURES. TEMPERATURES OF REDUCTION AND ACTIVITY.—C. Kelber. (Ber., 1924, **57**, 136–141.)

The author has shown that oxygen is not necessary for reduction by hydrogen in the presence of nickel. The metal, deposited on a carrier, regains its activity more rapidly than the pure metal when placed in hydrogen after preliminary inactivation by short contact with oxygen. Prolonged contact with oxygen prevents the re-activation of both forms, the catalytic activity apparently being completely destroyed by exposure to oxygen at 60–70°. The catalyst, deposited on a carrier, also reacts with water, hydrogen and a deposit of the oxide apparently being formed. Pure nickel remains unaffected. The deposited metal exhibits an optimum activity when prepared at 350°, but at 100° is inactive; on the other hand, pure nickel is practically inactive when prepared at 450° C. S. F. B.

CATALYTIC HYDROGENATION OF ORGANIC COMPOUNDS WITH COMMON METALS AT THE TEMPERATURE OF THE LABORATORY. VII.—HYDROGENATION WITH ELEMENTARY NICKEL IN THE ABSENCE OF OXYGEN.—C. Kelber. (Ber., 1924, **57**, 142–143.)

Nickel, prepared from nickel cyanide, readily reduces diphenylacetylene and azobenzene in hexane solution, thus establishing the fact that oxygen is unnecessary for the success of the operation. Nickel, prepared from the carbonate gives similar results, the optimum temperature for

the preparation, 300°, being the same in both cases. From this it appears that the activity of the two catalysts is similar. Less active specimens were prepared at higher temperatures. These results support the view that the loss in activity is due to a surface change. S. F. B.

TETRALIN: ITS HISTORY, MANUFACTURE AND USE AS A FUEL FOR INTERNAL-COMBUSTION ENGINES Fuel III., 346. Colonel Sir Frederick Nathan.

The process of hydrogenating naphthalene on a commercial scale was rapidly developed in Germany, on account of the shortage of liquid fuel during the war. Tetrahydronaphthalene (Tetralin) was first described by Baeyer. Sabatier and Sanderens employed metallic nickel to convert naphthalene vapour and hydrogen at 200° C. into tetralin. Professor Schroeter of Berlin found that the technical difficulty in the manufacture of tetralin on the commercial scale was the difficulty in obtaining pure naphthalene, and several methods have been patented for the purpose of purifying the raw substance. Hydrogen must also be pure, and is obtained by the Badische Anilin and Soda Fabrik process. Hydrogenation takes place in vessels, fitted with agitators, under a pressure of about 40 atmospheres at temperatures above 150° C. The hydrogen is injected into the mixture of liquid naphthalene and catalyst. As the reaction is strongly exothermic, heat is applied only to start the operation, and the course of the reaction can be followed by the temperatures attained. When reduction is complete the tetralin is distilled under reduced pressure. Tetralin is a colourless, stable, hydrocarbon having the following physical properties:—Specific gravity at 150° C., ·975: boiling point, 206° C.; flash point, 79° C.; freezing point, ·35; calorific value, 11,600 calories; vapour tension at 19° C., ·5 m.m.; vapour tension at 60° C., 10·0 m.m. Owing to its high boiling point it cannot be used as a motor fuel without mixing with petrol, benzol or alcohol. Comprehensive tests show that mixtures of tetralin and ordinary petrol start up rapidly from cold, but great difficulty in starting is experienced with mixtures containing more than 50 per cent. tetralin. Mixtures of petrol and tetralin containing less than 50 per cent. tetraline appear to be quite suitable for ordinary four-cylinder motor-car engines without special adjustments. Tetralin-petrol mixtures are not so good as petrol alone in flexibility of running, maximum power obtained or thermal efficiency. "Pinking" occurs less with mixtures than with petrol alone and decreases as the percentage of tetralin increases. There are indications that a higher compression ratio might be used with tetralin-petrol mixtures, with probable gain in power and efficiency. On a pint per b.h.p. hour basis the 50/50 tetralin-petrol mixture was the most economical mixture tested. With a greater percentage of tetralin in the mixture fair results are obtained, but the engine is much less flexible and power and efficiency decrease considerably. Generally, as the proportion of tetralin increases, so also do the faults associated with incomplete combustion, due to the low vapour tension of tetralin. R. P.

HYDROGENATION CATALYST.—W. B. Van Arsdel. U.S.P. 1,497,815 of May 6, 1924. (Appl. Oct. 11, 1921.)

Nickel oxide is mixed with a solution of sodium silicate and acidified with hydrochloric acid. A silica gel containing nickel hydroxide is thus produced which is washed, calcined at 450°, washed again, and reduced with hydrogen at 370°. S. F. B.

AN IMPROVED METHOD FOR THE PREPARATION AND RE-ACTIVATION OF METALLIC CATALYSTS USED IN THE HYDROGENATION OF OILS AND LIKE SUBSTANCES.—Technical Research Works, Ltd., and Ernest Joseph Lush. Brit. Pat. No. 221,000, Sept., 1924.

In the hydrogenation of oils, by passing them through a catalytic mass, as described in Pat. No. 203,218, the catalytic material becomes inactive. The object of the present invention is to re-activate the catalyst, for example, nickel turnings or powder, *in situ* by treatment with hypochlorous acid prepared electrolytically or by the action of an alkaline solution of hypochlorite, whereby an oxidised surface is formed on the metal, which is subsequently washed with water and reduced in hydrogen at 250° to 350° C. R. P.

ANALYSIS AND TESTING.

SURFACE TENSION OF OIL-IN-WATER AND WATER-IN-OIL EMULSIONS. S. S. Joshi. *Kolloid-Z.*, 1924, **34**, 197-201.

Surface tension measurements have been made by various methods on aqueous emulsions of kerosene and olive and castor oils, and of olive oil in sodium oleate solution, in order to test Quincke's conclusion that the surface tension of emulsions is less than that of pure water. It was found that, providing all non-emulsified oil is removed, the emulsion has the same surface tension as the pure dispersive medium, but the presence of non-emulsified oil, or other immiscible impurities, results in the surface tension being lowered. S. F. B.

SOLUBILITY OF GASOLINE (HEXANE AND HEPTANE) IN WATER AT 25°. L. H. Milligan. *J. Phys. Chem.*, 1924, **28**, 494-497.

The author describes a method for determining the true solubility of sparingly soluble liquids having an appreciable vapour pressure. He finds that 100 parts of water at 25° dissolved approximately 0·0014, 0·0007 and 0·07 volumes of hexane, heptane and benzene respectively. S. F. B.

VAPOUR DENSITIES OF BENZENE, TOLUENE, PHENOL AND THE CRESOLS. F. Burk. *Gas-v. Wasserfach*, 1924, **67**, 523-524.

The formula $D=0{\cdot}01605\ M.P/T$, where M is the molecular weight, P the pressure in millimetres of mercury and T the absolute temperature, has been used to calculate the values of the vapour densities of benzene, toluene, naphthalene and so on. The results over a wide range of temperatures have been tabulated. They are sufficiently accurate for use in chemical plant design. S. F. B.

COMBUSTION OF PETROLEUM HYDROCARBONS. C. F. Maybery. *Ind. Eng. Chem.*, 1924, **16**, 911.

The ultimate analysis of oils is generally regarded as a long, tedious operation necessitating careful supervision to ensure a high degree of accuracy. The author, who has had considerable experience in this class of analyses, describes the method and apparatus he employs. The oxygen supply, regulated from a 6 litre bottle, passes through two bottles

containing 50 per cent. potassium hydroxide solution on either side of which is a mercury seal, and then through a large U tube containing sulphuric acid. Two small U tubes containing sulphuric acid follow, one of which delivers oxygen just behind the boat, and the other in front near the copper oxide, at a rate of 1 bubble in 2 or 3 seconds. This arrangement prevents any accident caused by excess of pressure or mixing of the acid and potash. It is essential for complete combustion to have this dual oxygen supply to the combustion tube, and the author uses the highest temperature obtainable with a gas furnace for heating the copper oxide. Electric heating was found to be inferior to gas on account of the difficulty in regulating the initial stage of combustion. Absorption is carried out in two bulbs filled with sulphuric acid and 80 per cent. potassium hydroxide respectively and by weighing duplicate bulbs filled with oxygen and kept in a desiccator filled with that gas, much time is saved by carrying the weights forward from day to day and by weighing the bulbs filled with oxygen, sweeping out with air is unnecessary.

Two safety tubes, each filled with soda lime and phosphorous pentoxide follow the absorption bulbs, and a final aspirator fitted with a siphon is used to equalise the back pressure in the bulbs. In order to stand the high temperature employed the tube should be of the most inflexible Bohemian glass and the copper oxide a mixture of granulated and powdered forms.

The use of catalysts has been examined, but are not recommended. The method requires less than two hours for operation and has been found to be extremely accurate. S. B.

DETERMINATION OF NAPHTHENIC ACIDS. B. Tütünnikoff. *Seifensieder Zeitung*, 1924, **51**, 198-200.

The naphthenic acids, isolated from the waste lyes obtained when the lower and middle fractions from the petroleum distillations are refined, form copper salts, soluble in benzine to give a green solution when oxidised by alkaline permanganate. Oxidation of the petroleum distillates boiling below 200°, containing a large percentage of *cyclo*-pentane hydrocarbons, also give benzine-soluble copper salts. They are characterised by giving copper salts, insoluble in benzine, on further oxidation by alkaline permanganate and have been designated naphthylenic acids by the author. The relationship of the naphthenic acids to the origin of petroleum is also discussed, the results of these experiments pointing to an organic origin. S. F. B.

CATALYTIC DECOMPOSITION OF ETHYL ALCOHOL IN THE PRESENCE OF ALUMINA. J. E. Goris. *Chem. et. Ind.*, 1924, **11**, 449-452.

When ethyl alcohol is decomposed by alumina, heated at 430-450°, besides water and ethylene, hydrogen amounting to, roughly, 4·5 per cent. of the ethylene is also produced. This percentage rapidly increases with increasing temperature of the catalyst above the limit given. Since the volume of ethylene formed is a measure of the amount of alcohol present, the method can be used for estimating ethyl alcohol in a mixture of this substance with benzene, the latter being unaffected by the catalyst. In preparing the catalyst a mixture of equal weights of aluminium hydroxide and powdered pumice is powdered and heated to 300°.

S. F. B.

DETERMINATION OF VANADIUM BY REDUCTION WITH HYDROGEN PEROXIDE AND TITRATION WITH POTASSIUM PERMANGANATE. A. W. Hothersall. *J. Soc. Chem. Ind.*, 1924, **43**, 270.

The solution is digested with sulphuric acid until fumes are evolved, organic matter, if present, being destroyed by the addition of powdered potassium permanganate, removing excess of the latter with hydrogen peroxide and again evaporating until fumes appear. The cool liquid is now treated with hydrogen peroxide drop by drop until the vanadic acid is reduced to vanadyl sulphate then diluted to 300 c.c., heated to 70° C. and titrated with standard permanganate.

Iron, copper, molybdenum, arsenic and uranium do not interfere, but chromium gives high results. S. B.

THE INVESTIGATION OF BENZENE AND TURPENTINE OIL. J. Pritzker and R. Jungkunz. *Chem. Zeit.*, 1924, **48**, 455.

Ammoniacal nickel cyanurate is used as a means of detecting benzol in benzene or turpentine. The reagent prepared by dissolving 5 gms. nickel sulphate in 20 c.c. water, adding this to a solution of 2·5 gm. potassium cyanide in 10 c.c. of water and 20 c.c. of concentrated ammonium hydrate. The mixture is shaken, cooled to 0° C. and filtered, after which 50 c.c. acetic acid is added. This reagent gives a precipitate of $Ni(CN)_2NH_3C_6H_6$ with benzol, but does not react with the higher aromatics. Pyridine, thiophene and furfuran behave like benzol. The reaction can be made quantitative by taking 1 gm. of benzol or more of a mixture and shaking with 80 cc. of the reagent for five minutes. The precipitate is filtered, washed with water, alcohol and ether successively, dried over sulphuric acid and weighed. Factor for $C_6H_6 = 0·3793$. S. B.

THE RELATION BETWEEN THE TIMES OF FLOW OF THE KLEVER RAPID VISCOMETER AND THE ENGLER VISCOMETER. Von Helmut W. Klever, R. Bilfinger and K. Mauch. *Z. angew. Chemie*, 1924, **37**, 693-695.

The flow time of pipette in the rapid viscometer has no direct proportional relationship to the Engler time, this being found to be the case both with glass and brass nozzles to the pipette. The time curves for both glass and brass nozzles are similar. Each nozzle is found to require a separate calibration for the computation of Engler viscosity from the time of flow. The principal irregularities in this proportion are found between 6° and 9° of Engler viscosity, and amount to as much as 65° Engler. The curves obtained by plotting the Engler number as ordinate against the pipette flow time as abscissa are slightly concave. Further investigations are being made. H. M.

RAPID VISCOMETER. H. W. Klever. *Z. angew. Chem.*, 1924, **37**, 696-697.

The apparatus (G.P. 351,027) consists of a water bath containing an oil supply vessel (a large test tube) and a measuring pipette. The oil supply vessel has a brass cover provided with holes for the introduction of a thermometer and the measuring pipette. The bath is provided with a thermometer and hand stirrer. The pipette has level marks below and above the bulb, and a brass capillary nozzle is cemented to its lower end. For estimations at 20° C. and 50° C. the bath is filled with water; for estimations at 100° C., with glycerine. A long rubber tube is attached to the upper end of the pipette, and is provided with a pinch cock and

chloride of calcium tube. The oil vessel contains about 30 ccm. of the oil to be tested. When the oil is heated to the desired temperature the pipette is several times filled and emptied by means of the rubber tube and cock, and then filled to the upper mark with oil and withdrawn from the oil vessel, and the time required for the oil to flow out till it reaches the bottom mark observed. By very numerous experiments curves have been established giving the correct ratio between the readings from the pipette and the Engler number, and by the help of these the Engler number may be stated with sufficient accuracy for technical determinations. H. M.

DETERMINATION OF THE TEMPERATURE OF MISCIBILITY OF LIQUIDS. H. Rosset. *Ann. Chim. Analyst*, 1924 (ii.), **6**, 129-134.

The general theory of the change of miscibility of liquids with temperature is summarised. Apparatus is described for determining the critical temperatures of solutions of one liquid in another and also of the clouding points of mixtures of equal volumes of liquids. S. F. B.

A SEMI-MICRO DETERMINATION OF CARBON. M. Polonovski. *Bull. Soc. Chem.*, 1924, **35**, 414-419.

The micro determination of carbon by the Pregl method involves the use of a special sensitive balance and considerable manipulative skill. These disadvantages can be partly overcome by the use of the apparatus described in the paper. The procedure is almost identical with that generally employed. The combustion of the substance is carried out in a stream of oxygen, but a much smaller furnace and combustion tube than usual is used. The gases are absorbed by a strong solution of barium hydroxide, the resulting barium carbonate collected out of contact from the air, washed, dried and weighed. The precipitate is so heavy that less than 50 mg. of the substance need be taken to give a precipitate that can be weighed on an ordinary balance. A special feature of the apparatus is the provision of a test vessel containing barium hydroxide solution by means of which the gases can be tested for carbon dioxide at the commencement and end of the analysis. S. B.

CALORIFIC VALUE OF LIQUID FUELS. G. Morpurgo. *Mitt. Staatl. Techn. Versuchsamts*, **10**, 97-99.

The author finds that the calorific value of liquid fuels can be calculated with reasonable accuracy from the expression ; calorific value = (11,200 a +10,300 b. +8140 c +2500 s +10,000 d)/100 q, where a and b are the fractions of hydrocarbons, as determined by an Engler distillation boiling up to 110° and from 110-310° respectively, d is the distillation residue less coke and ash, c is the coke content and s the sulphur content. In arriving at this expression the proportion of each constituent is multiplied by its average heat of combustion. Thus b is reckoned as a petroleum mixture with an average heat of combustion of 10,300 cals. The coke content is found by slowly heating 2-3 gms. of the fuel in a covered crucible partly filled with freshly calcined alumina to 350-400° and finally to incandescence. The value for s is determined by repeated evaporation of a sample with fuming nitric acid, neutralisation with concentrated aqueous potassium hydroxide solution, calcination of a mixture of the

product with sufficient magnesium oxide to give a thick paste, and after treatment of the aqueous extract with bromine water, estimation of the sulphur as barium sulphate. S. B.

Motor Spirits and Oil Fuels.

Bench Experiments on Alcohol—Heavy Petrol Mixtures. O. W. Watson and W. R. Ormandy. *Chim. et Ind.*, May, 1924 (Numéro spécial), 276–280.

The tendency has been during recent years to include heavier fractions in petrol. Although these spirits give more calories per gallon than lighter fractions they are not so serviceable in internal combustion engines. Benzol reduces the tendency to premature explosion, but the benzol production is insufficient and the price in many cases prohibitive.

Ricardo's experiments have shown that alcohol possesses the power to suppress detonation in a greater degree than benzol, and whilst coal-tar benzol has a "toluene-number" of 65, alcohol used in small proportions has a "toluene-number" of 130 and in large proportions 160.

The London General Omnibus Company and the Distillers' Company have made experiments to determine if the addition of a relatively small quantity of alcohol would render inferior spirits serviceable or improve the spirits used.

Experiments have been made with a mixture of 100 bls. L.G.O. spirit and 100 bls. P.M.S. No. 1 (Power Methylated Spirit No. 1).

P.M.S. No. 1 consists of alcohol denatured by the addition of 2·5 per cent wood spirit, 0·5 per cent. pyridine, 5 per cent. benzol and a trace of colouring matter.

The mixture is lumped at $-24°$ C. At 10° C. the addition of water to the extent of 1 per cent. on the alcohol used causes separation.

The effect of varying quantities of water is shown by means of a curve.

Distillation curves are given for L.G.O. spirit, Shell No. 1, and a mixture of L.G.O. spirit and 10 per cent. of P.M.S. The addition of the alcohol causes a large increase in the proportion volatile below 90° C. and raises the curve during the whole course of distillation. The increased volatility at 90° C. doubtless improves the running of an engine. The elevation of the curve is probably due to the formation of low boiling mixtures by the alcohol and some of the constituents of the hydrocarbon.

In spite of the low calorific value of the P.M.S. the mixture has a calorific value only 2 per cent. lower than that of the spirit from which it was made.

The running experiments were made with a four-cylinder K motor engine, bore 100 mm., stroke 140 mm., coupled with a Froude dynamometer. The temperature of the cooling water entering and leaving the jacket was measured and also that of the oil and spirit. A thermostat was also fitted to the water-jacket. The heat necessary for carburation was supplied by a sleeve. Comparative experiments were carried out with P.M.S.–L.G.O. mixture, L.G.O. spirit and Shell No. 1, and were carried out at various engine speeds and conditions as to spark and charge. Curves showing petrol consumption under the varying conditions are given.

The results show that with this type of engine and using a variable advanced spark 2·3 per cent. more fuel is required when mixture is used than when straight petrol is used. With a fixed advanced spark the difference is not perceptible. Slightly more power can be obtained if fuel economy is not considered. The best results are obtained with a very advanced spark and by pre-heating the mixture admitted to the engine. It is apparently advantageous to add alcohol to poor spirits and difficulties with separation of the liquids were not experienced.

Three omnibuses were put in regular service with petrol-alcohol mixture, and although the experiments are not finished confirm the results obtained on the test-bench. T. A. S.

CARBURANT NATIONAL IN CZECHOSLOVAKIA: DYNALKOL. C. Vetrlik. *Chim. et Ind.*, May, 1924 (Numéro spécial), 281–2.

Czechoslovakia imports considerable quantities of petrol as the only important internal source of petroleum is Gbely, of which the production is not more than 10,000 tons per annum. Benzol and alcohol are produced in quantity, the coke-ovens producing 10,000 tons per annum whilst 1½ million hectolitres of alcohol are obtained from potatoes. Czechoslovakia has therefore its own "carburant national," dynalkol. Initial experiments were made with a mixture of 40 kg. 96·6 per cent. alcohol and 60 kg. 90 per cent. benzol. For aviation purposes a little lamp oil is added. To-day dynalkol is much used, although opposition from petrol competitors and users who had suffered from poor alcohol during the war had to be overcome first. Official departments display great interest in the new fuel.

Benzol for summer use has the following characteristics :—

	Per cent.
Volatile at 85° C.	48·0
„ „ 90° C.	78·0
„ „ 95° C.	87·5
„ „ 100° C.	91·5

whilst that for winter distils as follows :—

	Per cent.
Volatile at 90° C.	60
„ „ 117° C.	90
„ „ 134° C.	95

Benzol (90°) contains 0·1 per cent. paraffins and 0·6 per cent. of CS_2.

The benzol is considered sufficiently refined if when it is treated with 15 per cent. of 66° Be H_2SO_4 a colour no more intense than that of a solution of 2·5 g. of potassium dichromate in 1 litre of 50 per cent. H_2SO_4 is produced.

The alcohol must be 96·6 per cent. The price paid for the mixture does not remunerate the distillers. T. A. S.

TETRA-ETHYL LEAD AS AN ANTI-DETONATOR IN HIGH-COMPRESSION ENGINES. H. Kerr Thomas. *Auto. Engr.*, Oct., 1924, **14** (194), 308.

The author describes engine tests of a mixture of petrol with tetra-ethyl lead. The engine, which was designed for use on commercial vehicles, could be run with a compression-ratio of 4·33 : 1, 5·5 : 1 or 6·0 : 1. With the lowest ratio ordinary petrol was used, but with the two higher ones tetra-ethyl lead was added to the fuel, presumably

because ordinary petrol could not be used without detonation. The proportion of tetra-ethyl lead added was 8 c.c. (0·176 per cent.) per gall., as this was found to be the most effective mixture for the compression-ratio of 5·5 : 1. It is stated that the compound showed some tendency to decompose in solution, so that it was found necessary to add more tetra-ethyl lead as the test proceeded. By means of curves and tables the author shows that the higher compression ratios made possible by the use of the anti-knock result in increased power output and efficiency of the engine. At the conclusion of the tests, however, when the engine had been running for a total of 18 hours, violent pre-ignition set in, and it was impossible to run longer. On taking the engine down the combustion chambers, valves and plugs were found to be heavily coated with a deposit of lead peroxide. In a note following the paper Dr. Ormandy gives a brief sketch of the work of Midgley and Boyd on anti-knocks, and explains that the above work was done before it was known that in practice halogen-containing compounds, such as carbon tetrachloride and ethylene dibromide, were used in conjunction with tetra-ethyl lead with a view to minimising the undesirable effects. Dr. Ormandy points out that the mechanism of the action of these anti-knocks is still a mystery, but states that he has determined that the spontaneous ignition temperature of paraffins to which tetra-ethyl lead has been added is, contrary to expectation, actually lower than that of the original hydrocarbons. S. T. C.

"Dynalkol," a New Motor Fuel. *Petr. Times*, Oct., 1924, **12**, 300.

Dynalkol is a motor fuel developed in Czechoslovakia. It is stated to consist of a mixture of benzol and alcohol to which about 1 per cent. of naphthaline or 1 per cent. of tetraline or 5 per cent. of ether has been added. It is estimated that under existing conditions the quantity of dynalkol which could be produced from domestic sources would supply half the requirements of motor-fuel in the country. It is stated to be cheaper than petroleum spirit and has been employed by Government services for some time. S. T. C.

Motor Fuel. D. O. White. U.S.P. 1,501,383 of July 15, 1924. (Appl. Aug. 28, 1923.)

The fuel consists of alcohol with a small portion of ammonium chloride. T. A. S.

A Device for Supplying an Internal Combustion Engine with a Catalysed Mixture of Water Vapour and Hydrocarbons with Air. C. E. Laurent. E.P. 197,647 of July 1, 1924. (Conv., France May 13, 1922.)

The induction pipe of an internal combustion engine is fitted with an enlarged portion containing catalyst in the form of balls or sheets. The catalyst is a mixture of a compound of silver, arsenic, mercury phosphorus, barium, sulphur, selenium, tellurium boron; carbon in the form of graphite, coal or coke and a salt of lead, zinc, tin, antimony or alumina, silica, magnesia. Hydrocarbon and steam are passed into the catalyser, steam being generated by passing water through a coil situated in the exhaust pipe. A carburettor of the ordinary type is used for starting the engine. It is claimed that 50–60 per cent. of the fuel can be saved with this device. T. A. S.

IMPROVED APPARATUS FOR DEHYDRATING MIXTURES OF ALCOHOL AND LIQUID HYDROCARBONS. Ricard, Allenet and Co. E.P. 204,697 of Sept. 14, 1923. (Conv., Belg., Sept. 20, 1922.)

A mixture of hydrocarbon and 95 per cent. alcohol is passed several times downwardly through a dehydrating substance (potassium carbonate on pumice stone is suitable), dissolves in the water and falls to the bottom of the tower where it is removed and distilled to recover any spirit. It is immaterial whether the original mixture of alcohol and hydrocarbon was miscible or not. The potassium carbonate is recovered by heating to 135–140° C. T. A. S.

DEHYDRATING MIXTURES OF ALCOHOL AND LIQUID HYDROCARBON; APPARATUS FOR. Société Ricard, Allenet et Cie. E.P. 204,697 of Sept. 14, 1923.

Mixtures of aqueous alcohol and petrol are dehydrated, so as to render them mutually soluble, in an apparatus consisting of a series of vertical cylinders containing dehydrating materials, such as carbonate of soda or carbide of calcium mixed with pumice stone or other inert porous material. Suitable piping enables the mixture of liquids to flow from the bottom of one cylinder to the top of the next, or any cylinder of the series may be cut out for recharging with dehydrating material. Continuous operation is thus provided. The downward directing of flow consists in carrying the completely hydrated and liquid dehydrating material to a sump at the base of the cylinders from which it is automatically removed for recovery. F. G. P. R.

RECOVERY GASOLINE. F. E. Hosmer. U.S.P. 1,510,433 of Sept. 30, 1924. (Appl. May 4, 1922.)

Natural gas is compressed and the condensate separated. The easily volatile portions are removed from the condensate, the residue being used to scrub the residual gas. T. A. S.

PROCESS OF RECOVERING GASOLINE. F. E. Hosmer. U.S.P. 1,510,434 of Sept. 30, 1924. (Appl. June 6, 1923.)

Oil, which has been used in scrubbing natural gas, is sprayed down a tower, where it is maintained at or near atmospheric pressure and under such conditions loses part of its lighter fractions. The oil is now sprayed into a tower under a pressure below atmospheric, the gases evolved in the first operation being passed up the tower. The resulting vapours are condensed and the residual oil is used to scrub new natural gas. T. A. S.

CENTRIFUGAL PROCESS OF BLENDING OIL AND GAS. G. M. Turner. U.S.P. 1,510,353 of Sept. 30, 1924. (Appl. May 7, 1920, and January 4, 1921.)

Natural gas, and oil for absorbing the gasoline from it, are forced under pressure into a rotating machine in which centrifugal force causes a layer of oil to be held to the walls of the machine whilst the gas bubbles through it. Oil and extracted gas are removed from the machine, gasoline being recovered from the oil. T. A. S.

MANUFACTURE OF LIQUID FUEL. J. Dolphen, Assr. to F. Nostettler. U.S.P. 1,493,874 of May 13, 1924. (Appl. January 18, 1922.) *Cf.* E.P. 174,360 and 176,329 of 1922.

The fuel consists of a crude oil belonging to the aliphatic series and boiling between 130°–400°, tar hydrocarbons boiling below 300°, and a small quantity of acetone. T. A. S.

SOLIDIFIED LIQUID FUEL. H. Kranich, Assr. to S. Sterman and Co.

The solidified infusible fuel consists of 5 parts alcohol, 1 part pyroxyline, 1 part acetone, 75 parts of a 5 per cent. solution of ammonium nitrate in alcohol, and a small proportion of sericose. T. A. S.

LUBRICATING OILS AND WAXES.

METHODS OF TREATING LUBRICATING OILS. Carl J. von Bibra. *Ref. and Nat. Gas. Mfr.*, 1924, **3**, 6, 9.

The types of oil produced and the methods employed for the manufacture of lubricating oils from Californian wax-free crude oils are discussed.

Recent developments in refinery practice include the use of high speed centrifuges for reducing the settling time after soda washing and the use of finely pulverised adsorptive clays and earths as filtering agents. There are two general classes of finely powdered filtering materials—(1) natural earths or clays similar to fuller's earth; (2) clays having little or no filtering value in their natural state which are given a high adsorptive power by chemical treatment. The clays are used either dry or in the form of a mud. In the former case refining is carried out by stirring the oil with a very finely pulverised adsorptive material at elevated temperatures in a closed agitator, followed by filter pressing. In the latter case the first stage consists in the preparation of "mudded clay" by treating a very finely ground inert clay with dilute sulphuric acid. The soluble reaction products are leached out with water and the treated clay settles in the form of a mud. Oil which has been acid washed and given a water "knock down" is thoroughly mixed with the "mudded clay." The mixture is then passed through a pipe still in which the water is driven off. The mixture is now agitated by live steam and then passed through a cooler into a filter press. The oil leaving the press is of good colour and will comply with government and commercial acidity specifications. The proportions of "mudded clay" used to oil refined are not stated, but the efficiency of this agent is given as 5·5 times that of fuller's earth. If the material is dried and stored in sacks for two to three months its efficiency falls to 3·3 of that of the same sample of fuller's earth.

By appropriate choice of treated and natural highly adsorptive clays the selective adsorption of certain impurities is possible.

R. W. L. C.

TURBINE LUBRICATION. N. E. Funk. *Ind. and Eng. Chem.*, 1924, **16**, 1080.

Many of the problems of the application of the lubricant to steam turbines have been successfully worked out, but the problem of the

successful lubricant itself has as yet reached a less satisfactory stage. Only one type of lubricant can be used. The desirable characters and function of the lubricant are discussed at length. Resistance to organic acid formation, sludging and emulsification and low viscosity are essential characteristics. A survey of 80 large steam turbines showed that in the aggregate these units were out of service 2 per cent. of the time owing to the necessity of cleaning sludge deposits from the lubricating systems. R. W. L. C.

VISCOSITY OF MINERAL OILS. LAW OF MIXTURES. Christian Leu. *Mon. petrole Roumain* **23**, 1672–1679; **24**, 615-619.

The lack of success in formulating a mathematical expression for calculating the viscosity of binary liquid mixtures is discussed. This is attributed to the fact that the viscosity curve has been assumed to be of a linear exponential nature, whereas the true viscosity curve plotted against temperature, or concentration, is an equilateral hyperbola for ideal mixtures. Deviations from the ideal curve are due to molecular association or dissociation causing a "secondary depression of viscosity." The results obtained from a large number of experiments on mixtures of mineral oils show that this depression manifests itself by a permanent coefficient over the whole range of experiments, and over the complete distance between the viscosity limits. It is characteristic for each petroleum fraction. Ten formulæ are given for expressing the ideal curve and for determining the coefficient of the secondary depression. It is suggested that this is a criterion for the lubricating value of a lubricating oil. Theoretical values calculated on these formulæ are stated to be within 1 per cent. of the experimental values. S. F. B.

OXIDATION OF MINERAL OILS BY AIR. J. Kryspin. *Eleventh Rept. Fuel Tech. Inst. Czech. Polytech. Highschool (Prague)*, 1922-23, 97.

Transformer oils, containing pyrogallol, α-naphthol or *m*-cresol in the proportion of 0·1 g. per 30 g. oil, were treated with a slow current of oxygen at 120–122° for 60 hours in order to examine the effect of these phenols in preventing oxidation. The quantities of asphalts and resins, determined by the Kissling method, showed that these substances have no effect on the oxidation. S. F. B.

THE REFINING OF TRANSFORMER OILS. J. Hladky. *Eleventh Rept. Fuel Tech. Inst. Czech. Polytech. Highschool (Prague)*, 1922-23, 98.

Transformer oils, answering Kissling's test (less than 0·6 per cent. of resins and asphalts formed when a slow steam of oxygen is blown through the oil (30 g.) for 60 hours at 120°), are produced by treatment with sufficient bleaching powder. The quantity of sulphuric acid used exerts a considerable influence in the method of preparation. S. F. B.

IMPROVEMENTS IN SETTLING APPARATUS. The Dorr Co. E.P. 211,482 of Aug. 7, 1924.

It has been customary to employ circular tanks for settling operations involving the handling of liquids in which solids are present in suspension

for the reason that conveyors consisting of arms on a vertical rotating shaft can be used for the removal of settled solids from the tank.

The improvement provides rotary scraping mechanism which is capable of functioning in tanks substantially rectangular in section. The scraper consists of a sweep with a rigid inner section and an outer section pivoted to it to accommodate itself to variations in the radial extent of the surface. R. W. L. C.

CERESINS. Stuart Lawson. *Oil Engineering and Finance*, 1924, **5**, 101, 522–523.

The author differentiates between ceresins, which occur in natural oils, and paraffin waxes, which are found in shale oils and heavy distillates. The ceresins are much less soluble in ether-alcohol mixture than the paraffin waxes; they are quickly precipitated, even from the warm solution, and come down in an amorphous form. Unlike waxes, ceresins become discoloured on keeping. Details are given of a method by which both ceresins and asphaltum have been estimated in thirty dissimilar samples of oils from the Wyoming district, in order to ascertain whether they are of common origin. It is also shown that the ceresins may be fractionally crystallised from ether-alcohol mixture; it is claimed that at least two individuals (of m.p., respectively, 60° C. and 72° C.) are present, and that the ceresins from the thirty different oil samples are identical. W. S. N.

DETERMINATION OF THE SETTING TIME OF PARAFFIN WAXES. K. Fricke, *Chem. Zeit.*, 1924, **48**, (107), 624–625.

The setting time of the paraffins of high melting point (54°–60° C.) is less than that of the paraffins of low melting point (50°–52° C.), and a low setting time is very desirable in the candle manufacture. To determine the setting time, 100 gms. of wax are melted in a large porcelain dish, an immersed thermometer showing a temperature of about 65° C. The melted wax is poured into a small tinned dish and the room temperature noted, which should be about 20° to 22° C. When the wax is almost set, that is, in a period of 45 to 60 min., tests are made with a square plunger loaded with 1 kg. till it only makes a plainly distinguishable superficial impression. The period from the pouring out of the wax is taken as the setting time. Fairly concordant results are obtained in repeated tests. The setting time of high-melting wax (of 54–56° C. m.p.) is 50–60 min.; for middle quality paraffin wax, 60–70, min. and for ordinary block paraffin (50–52° C. m.p.), 70–80 min. H. M.

PROCESS OF LOWERING THE COLD TEST OF LUBRICATING OILS.—J. W. Weir and W. J. Ryan. U.S.P. 1,509,325 of Sept. 23, 1924. (Appl. June 21, 1920.)

Lubricating oils containing wax are diluted and a finely divided wax-adherent medium is added. The whole is then cooled when the wax adheres to the solid matter and is removed by filtration. T. A. S.

METHOD OF TREATING PETROLEUM OIL. J. W. Weir. U.S.P. 1,509,326 of Sept. 23, 1924. (Appl., June 11, 1924.)

Discoloured wax-containing oil is treated with a ground decolorising agent at a temperature of about 70°. The mixture is then cooled so

that the wax congeals on the decolorising medium and is removed by filtration. T. A. S.

APPARATUS FOR TREATING OILS. H. T. Maitland, Assr. to Sun Oil Co. U.S.P. 1,505,479 of Aug. 19, 1924. (Appl., April 19, 1921.)

Acid sludge, obtained in the treatment of mineral oil lubricating stock, is placed in a jacketed vessel fitted with a stirring device and fixed cross-bars. There is a large free space above the stirrers. Treating fluid is admitted at the bottom of the vessel. Light constituents are caused to overflow through an outlet in the upper part of the vessel. T. A. S.

IMPROVEMENTS RELATING TO TREATING OILS, WAXES AND THE LIKE TO REMOVE OR RECOVER SUBSTANCES THEREFROM. The Silica Gel Corp., Assees. of W. A. Patrick and E. B. Miller. E.P. 195,055 of March 1, 1923. (Conv., U.S., March 16, 1923.)

Oils are purified by treatment with absorbent mineral oxide gel, such as silica gel, capable of absorbing 10 per cent. of its own weight of water at 30° when in equilibrium with water vapour at a partial pressure of 22 mm. The operation is preferably carried out in apparatus in which the oil is treated in a counter-current manner, in stages, with the gel. The absorbed material may be recovered from the gel in fractions by treatment with water as preferential removal of the lighter bodies takes place first. A cracked gasoline containing sulphur can be refined by this treatment, yielding an oil containing 10 per cent. of unsaturated bodies, less than 0·02 per cent. of sulphur, and which does not form gum on exposure to light and air. By treatment of the gel used with water an oil containing 25 per cent. of unsaturated bodies and suitable for use in the flotation process for the recovery of minerals can be obtained. After removal of the absorbed bodies the gel is activated by treatment with steam. T. A. S.

METHOD OF EXTRACTING WAX FROM WAX-CONTAINING HYDROCARBONS. J. W. Weir. U.S.P. 1,505,453 of Aug. 19, 1924. (Appl. January 10, 1923.)

Wax is separated from hydrocarbon oil in a centrifugal machine in which it is thrown to the periphery. Hot hydrocarbon oil is introduced near the periphery and melts the wax. The combined wax and hot hydrocarbon are withdrawn separately from the oil with which the wax was previously mixed. T. A. S.

APPARATUS FOR SWEATING OR CRYSTALLISING PARAFFIN OR OTHER WAX. Hugh L. Allan and James Moore. U.S.P. 1,504,923.

An improved form of sweating stove comprising a number of horizontal heating and cooling cells is described. A casing enclosing the spaces between these cells provides enclosed intermediate compartments in which the wax can be heated or cooled uniformly out of direct contact with air. It is claimed that complete temperature control can be obtained and the formation of undesirable foliaceous crystals which occlude oil avoided. R. W. L. C.

Coal, Shale, Pitch, and Asphalt.

California Patents New Shale Distillation Process.—*Oil Trade J.* **15**, (10), 26.

Robert W. Jenkins, in his process, uses a horizontal, rotary, internally fired retort, with the fire in direct contact with the shale. The vapours are drawn off through the condensers by a suction pump. The vapour line is used for a portion of its length as a feed tube; the hot vapours being drawn over the shale which is fed to the retort by a worm conveyor. Oxidation is prevented by limiting the air supply and steam is used in the retort. The plant can be operated in large units of 500 tons per day throughout; it has low heat loss, low operating temperatures, a low maintenance cost. It is a continuous process and control is easy as the throughput can be varied by changing the rate of feed. The inventor claims that a large unsaturated content in the oil is avoided by the process. R. P.

New Shale Distillation Process Uses Natural Principles.—*Oil Trade J.* **15**, (10), 44. C. O. Sprenger.

M. J. Trumble, the inventor, combines shale retorting and cracking in this process. The shale is preheated to about 200° C., in a preheater above the retort, by the heat produced in decarbonising the spent shale. From the preheater the shale passes down into a retort of vertical type. Vapours from the cracking still enter the bottom of the retort, come into contact with the preheated shale, losing part of their heat and raising the temperature of the shale. Finally, superheated steam is injected to complete the process. The products from the retort go to the dephlegmator, where separation of the light and heavy oil is effected. The light oil passes to an agitator where pyridine, etc. are removed as acid sludge and the oil is redistilled to water-white gasoline. The heavy oil returns to the cracking stills which are horizontal tubes. Superheated steam about 650° C. is injected into the inner tube and supplies the heat for cracking. The loss of heat is made up by returning the steam to the superheater. The carbon which accumulates in the cracking tube is removed by a revolving spiral device. The hot spent shale from the retorts and the hot carbon from the cracking stills pass into a decarboniser, which is also the preheater for the raw shale. The superheater is of special design, and is placed below the boiler, which is heated by the waste gases from the superheater. Steam and oil vapours from the retort pass through a steam turbine, which generates electricity for general power use. The steam passes from the boiler, at 100 lbs. pressure, to the superheater, then to the cracking stills, back to the superheater, then to the retort, then through the turbine, into the dephlegmator and finally to the condenser. It is claimed that this Trumble process will distil as much carbonaceous material in 30 minutes as an ordinary retort can do in eight hours. Shale from Colorado returned a crude oil yield of from one to two-and-a-half barrels per ton, with an average of 60 per cent. cracked gasoline and tests on sub-bituminous coal of California yield an average of 54 gallons per ton, leaving a smokeless fuel of commercial value. R. P.

Trumble Oil-Shale Cycle Distillation Plant.—V. C. Alderson. *Quarterly Colorado School of Mines*, 1924, **19**, No. 3.

The plant is of experimental size and consists of a combination of retort, still and cracking still, so that the operation of producing finished pro-

ducts from shale is direct and continuous. Broken shale is fed into a hopper where it is preheated to 400° F. by means of spent shale from the retort, which is fed direct at a temperature of 1000° F. into a jacket surrounding the hopper and employed as a producer gas plant. On entering the retort the temperature of the warm shale is further raised by means of hot gases from the cracking stills, and is then brought to a final temperature of about 1000° F. by means of an injection of steam superheated to 1200° F. The gas, steam and oil vapours pass through a turbine, which is employed to generate electric current for working the plant, and then through fractional condensing columns. The petrol fraction is delivered to washers whilst the heavier portions of the oil are run to the cracking stills, which are heated by means of steam at 1200° F. passing through two concentric tubes within the still. When running the plant is said to produce twice the amount of heat necessary for all retorting, distilling and mining operations. No figures are given for yield of oil from any shales, or yields of petrol from the crude oil. An analysis of petrol is given, and the point mentioned that the percentage of saturated hydrocarbons in both crude oil and petrol is unusually high.

F. G. P. R.

U.S. Government Master Specification for Asphalt for Waterproofing and Damp Proofing.—*Circular of the Bureau of Standards* 160, 1924, 9 pages.

This specification (No. 85), officially adopted on December 29, 1923, applies to asphalt intended for use for roofing and waterproofing, as a plying cement in the construction of membrane waterproofing, or as a damp-proof coating. It is specified that the appearance when freshly melted shall be black and glossy, and not become dull in a week. The melting point is to be 140–171° F.; the penetration at 77° F., 25–50; the penetration at 32° F., minimum, 10; the penetration at 115° F., maximum, 100; ductility, minimum, 15 cm.; volatile matter at 325° F., maximum, 1 per cent.; decrease in penetration at 77° F. after heating, maximum 40 per cent., and solubility in carbon bisulphide, not less than 99 per cent. It shall be packed in steel drums or suitable containers. The methods of testing are described, and are for the most part those of the A.S.T.M. Standards. The melting point is determined by the ring and ball method.

H. M.

U.S. Government Master Specification for Coal-Tar Pitch for Roofing —*Circular of the Bureau of Standards* 157, 1924, 10 pages.

This specification (No. 80), officially adopted on December 29, 1923, applies to coal-tar pitch for use with coal-tar saturated rag felt for roofing and waterproofing. It is specified that the appearance when freshly melted shall be glossy black, and shall not become dull in a week. The m.p. is to be 140–150° F., the ductility, minimum, 50 cm.; the specific gr., 1.22—1.34; the free carbon content, 15–30 per cent.; the distillation test, not more than 12 per cent. by weight below 572° F., and the sp. gr. of the distillate not to be less than 1.03; the pitch to be put up in steel drums, wooden barrels, or suitable containers. Directions are given for sampling, and the methods of testing are described. The m.p. is determined by the cube in water method of the A.S.T.M. standards.

H. M.

CANADA—DEPARTMENT OF MINES—SUMMARY REPORT ON MINES BRANCH INVESTIGATIONS, 1922 (page 219). Report on the treatment of oil shale from New Brunswick by the Ryan Oil Digestion process. By A. A. Swinnerton.

The process consists of the "digestion of the shale in a closed retort with a body of relatively heavy oil under the influence of heat" and "at a temperature insufficiently high to effect substantial reduction of heavy fractions, but high enough to effectively liquefy heavy hydrocarbons in the said solids." The paper is a description of the laboratory experimental run, giving a summary of the results obtained. The conclusions arrived at are that the claims made for this process were not substantiated. W. H. T.

IMPROVEMENTS IN AND RELATING TO BITUMINOUS COMPOSITIONS.—F. E. Atherton. E.P. 220,393 of May 22, 1924.

Stable emulsions containing bitumen are prepared by agitating a dilute solution of emulsifying agent with the molten bitumen, and adding a stabiliser and a weak flocculating agent. Silicic acid and common salt are preferred as stabiliser and flocculating agents. A stable emulsion is prepared as follows:—Caustic soda (0.2 pts.) is dissolved in 10 pts. of hot water, and 9 pts. of oleic or other fatty acid added with agitation. This mixture is slowly added with vigorous agitation to 50 pts. of bitumen or pitch of melting point not higher than 60° C. The mixture is kept at 220–230° F., and hot water added to make the charge up to 100 pts. A fractional percentage of flocculating agent is now added to the emulsion and a similar quantity of silicic acid. Too much salt or too high a permanent hardness in the water gives unsatisfactory results T. A. S.

OIL SHALE EXTRACTION PROCESS.—R. W. Jenkins. U.S.P. 1,500,323 of July 8, 1924. (Appl. May 12, 1921.)

Shale is passed into an inclined retort where it is heated by direct contact with a flame. The vapours from the retort are condensed. T. A. S.

IMPROVEMENTS IN OR RELATING TO DESTRUCTIVE DISTILLATION APPARATUS.—F. Lamplough. E.P. 221,009 of June 1, 1923.

Shale is passed through jacketed horizontal retorts arranged in vertical rows. Two or more rows of retorts are used, the retorts of one row being staggered with respect to those in the other row. Each retort is fitted with a screw conveyor, and shale carried along the upper retort is transferred to the one below and similarly through the series, the spent shale being discharged at the end of the lowest retort. The retorts are set in a furnace setting. Steam is passed into the uppermost jacket and passes in turn through all the jackets. On reaching the lowest retort the steam has attained a temperature of 300–400° C., and is now brought in contact with the shale where it assists in removing the hydrocarbon vapours. The use of a steam jacket prevents direct heating of the shale with consequent objectionable reactions. T. A. S.

IMPROVEMENTS IN PROCESSES OF TREATING CARBONACEOUS MATERIALS.—M. J. Trumble. E.P. 221,052 of July 12, 1923.

Carbonaceous material such as lignite, wood, waste coal, etc. is placed in retorts and treated with steam superheated to 800° C. Oil or a mixture of oil and solid material is also passed into the retort, whereby the coke residue is rendered harder and more suitable for metallurgical processes.

The mixture of steam and vapours is passed through a prime mover such as a turbine, before proceeding to dephlegmators where the heavy and light oils are removed. The heavy oil is mixed at the base of the dephlegmator with carbonaceous material and is subsequently returned to the retorts. The lighter fractions are recovered as gasoline and uncondensible gas is used in superheating the steam. A plurality of retorts enables the process to be carried on continuously. T. A. S.

SHALE RETORT.—P. L. Bennett. U.S.P. 1,501,881 of July 15, 1924. (Appl. April 12, 1922.)

The retort consists of an elongated housing containing heating coils. A distillation plate extends above the coils. A conveyor band of chain-like-netting carries shale along the plate. A series of scrapers are arranged transversely to the plate and slightly above the conveyor. Vapour outlets are provided in the top of the housing. T. A. S.

SHALE RETORT.—D. H. Francis. U.S.P. 1,503,234 of July 29, 1924. (Appl. May 2, 1921.)

Shale is delivered on to the centre of a heated horizontal hearth and caused, by means of a rotating wheel, to pass to the margin of the hearth. Means are provided to scrape the spokes of the wheel. T. A. S.

SHALE DISTILLATION APPARATUS.—R. M. Catlin, Assr. to Catlin Shale Products Co. U.S.P. 1,503,093 of July 29, 1924. (Appl. Aug. 4, 1920.)

The shale receptacle has a perforated inner lining forming an annular space for the escape of gas. The gas can be drawn off and after heating passed into the body of the shale whence it escapes radially to the annular space. Means are provided for drawing off liquid products.

T. A. S.

CURRENT BIBLIOGRAPHY.

Compiled by W. J. Wilson, F.I.C., A.C.G.I.

1. Geological.

Structures Point to Oil.—U.S. Bureau Mines works out Geology of North-Eastern Colorado. *Petr. Age* **14**, (9), 18.

Oil Geology of the Future.—K. C. Heald. Amer. Assoc. Petr. Geol. *Petr. World* **21**, 397.

Teapot Dome Naval Reserve No. 3, Wyoming.—F. G. Clapp. *Oil Trade J.* **15**, (6), 58. *Oil Trade* **15**, (9), 60.

Some Peculiar Aspects of Torrance Field.—A. J. Mason. *Oil Weekly.* **34**, (8), 24.

Elements of Petroleum Geology.—F. M. Van Tuyl.

Further Consideration of Prospects for Oil in the Decatur Area.—D. M. Collingwood. Illinois Geol. Surv. *Oil News* **16**, 504.

Structure Finding Simplified by the Use of Diamond Drills.—K. Peters. *Oil and Gas J.* **23**, (14-A), 80.

Predicts Advances in Oil Geology.—K. C. Heald. *Oil and Gas J.* **23**, (16-A), 32.

Association of Petroleum Geologists.—J. H. Gardner. *Oil and Gas J.* **23**, (19-A), 221.

Researches in Geology of Finding and Recovery of Oil.—D. White. Intern. Petr. Congress. *Nat. Petr. News* **16**, (43), 85. *Oil and Gas J.* **23**, (20-A), 64A. *Petr. World* **21**, 515.

Oil Production Prospects in the Coastal Belt of Columbia.—L. Owen. *Oil Engineering and Finance* **5**, 624.

Bibliography of North American Geology for 1921–22.—J. M. Nickles. U.S. Geol. Surv.

Subsurface Study in South-east Kansas.—H. A. Ley. *Oil Weekly* **35**. (5), 30.

Notes on the Clinton Sandstone in Ohio.—J. R. Lockett. Ohio Academy of Science. *Nat. Petr. News* **16**, (44), 73.

Reynosa Escarpment of South Texas and its Relation to Oil.—S. C. Lowe. *Oil and Gas J.* **23**, (23-A), 104.

Conditions and Possibilities of the Hotmire Oil Field of Indiana. W. N. Logan. *Nat. Petr. News* **16**, (8), 56.

Petroleum Prospecting in Mississippi.—*Ninth Report of Directors of State Geol. Surv.*

EXAMINATION AND CORRELATION OF FIELD SAMPLES IN GULF COAST.—G. M. Bevier. *Nat. Petr. News* **16**, (13), 85.

NEWCOMERS ACTIVE IN SALT DOME FIELDS: HISTORY AND SOURCE OF OIL.—P. Wagner. *Nat. Petr. News* **16**, (14), 85.

2. GEOGRAPHICAL.

SEE SIGNS OF OIL IN CUBA.—A. Wright and P. W. K. Sweet. *Bull. Amer. Petr. Geol. Petr. Age* **14**, (8), 64.

CANADIAN OIL PRODUCTION IN 1923.—Dominion Bureau of Statistics. *Petr. World* **21**, 420.

ANALYSIS OF CRUDE PETROLEUM FROM MATAPAU, NEW GUINEA.—Mandated Development Co., Ltd. *Petr. World* **21**, 423.

WAINWRIGHT OIL WELL.—*Scient. and Ind. Research Council of Alberta, Report for* 1923. *Petr. World* **21**, 428.

THE POLISH OIL INDUSTRY.—E. Luboff. *Oil News* **16**, 382.

THE HISTORY OF OIL DEVELOPMENT IN OHIO.—G. A. Whitney. Derrick Publishing Co., Oil City, Pa.

THE PETROLEUM FIELDS OF THE SANTA ELENA DISTRICT OF ECUADOR.—*U.S Commerce Repts. Petr. Times* **12**, 532.

THE EGYPTIAN PETROLEUM INDUSTRY.—*Dept. of Overseas Trade Report. Petr. Times* **12**, 536. *Petr. World* **21**, 406.

MINING AND REFINING AT PECHELBRONN.—E. C. Isom. *Oil and Gas J.* **23**, (10-A), 124 *Chem Abstr.* **18**, 2957.

OIL POTENTIALITIES OF MEXICO.—G. Howell.—*Oil Engineering and Finance* **5**, 559.

PETROLEUM IN JAPAN.—A. T. Coumbe. *U.S. Bur. Foreign and Domestic Commerce Trade Information Bull.* 245. *Oil Engineering and Finance* **5**, 450, 501, 567.

CANADA'S LIQUID FUEL PROBLEM.—G. S. Hulme. Brit. Assoc. for the Advancement of Science. *Chem. and Met. Eng.* **31**, 508.

THE SIGNIFICANCE OF THE OIL CONSUMPTION OF 1923.—H. S. Fox. *U.S. Commerce Rept.* 36. *Petr. Times* **12**, 570.

PETROLEUM PROSPECTS IN AUSTRIA.—K. Friedl. *Petroleum* (Aug. 20). *Petr. Times* **12**, 585.

ANALYSIS OF SOME UNITED STATES GASOLINES.—A. C. Zimmerman. *Air Service Information Circ. (Aviation)* **5**, (465).

THE ARGENTINE PETROLEUM INDUSTRY.—*U.S. Commerce Rept. Petr. Times* **12**, 612.

RAGLE POOL PROVEN PROLIFIC SHALLOW AREA.—H. H King *Oil Weekly* **3**, (13), 43.

QUEMADO PETROLEUM (ARGENTINE).—E. Longobardi. *Anales assoc. quim. Argentina* **11**, 365. *Chem. Abstr.* **18**, 3111.

THE ACTUAL STATUS OF THE OLEIN, STEARIN, SOAP, MINERAL OIL AND ALLIED INDUSTRIES IN ITALY.—S. Fachini. *Atti congresso naz. chim. pura applicata* 1923, 345. *Chem. Abstr.* **18**, 3118.

DISCOVERER'S OWN STORY OF THE NEW GUINEA OIL.—J. Spencer. *Oil News* **16**, 457.

ROUMANIA'S NEW MINING LAWS.—Ministère de l'Industrie et du Commerce (Roumania). *Petr. Times* **12**, 637.

PETROLEUM IN JAPAN.—A. T. Coumbe. *Ideal. Petr. Times* **12**, 661.

BATSON WELL SHOWS LONGEVITY OF COASTAL FIELDS.—F. Ennist. *Oil Trade J.* **15**, (6), 31.

VENEZUELAN OIL HANDBOOK.—M. O'Shaughnessy. Potter and Co., New York.

RAINBOW BEND MAY BE NEXT MAJOR FIELD IN MID-CONTINENT AREA.—A. F. Hinton. *Nat. Petr. News* **16**, (34), 29.

THE REFINING INDUSTRY IN GREAT BRITAIN.—M. M. Mitchell. *U.S. Commerce Repts. Oil News* **16**, 487.

U.S. OFFICIAL REPORT ON RUSSIAN OIL.—C. E. Kern. *Oil and Gas J.* **23**, (14-A), 28.

DEEPER DRILLING PRODUCES BIG WELLS.—R. T. Baker. *Oil and Gas J.* **23**, (14-A), 32.

HONG-KONG PETROLEUM TRADE IN 1923.—*U.S. Commerce Repts. Petr. World* **21**, 442.

CONDITION OF RUSSIAN OIL INDUSTRY.—A. Serebrovsky. Inter. Petr. Congress. *Petr. World* **21**, 447. *Oil and Gas J.* **23**, (20-A), 178.

ITALY: PRODUCTION IN 1923.—*U.S. Commerce Rept. Petr. World* **21**, 455.

FACILITIES AT MEXICAN OIL PORTS.—G. F. Leechman. *Petr. Times* **12**, 681.

LIMELIGHT IN COLORADO TURNS FROM WESTERN SLOPE TO EASTERN PLAINS AREA.—C. D. Lockwood. *Oil and Gas J.* **23**, (15-A), 20.

GASOLINE PRICES AROUND THE WORLD.—C. E. Kern. *Oil and Gas J.* **23** (15-A), 28.

SCENIC BEAUTY IN WESTERN OIL FIELDS.—C. D. Lockwood. *Oil and Gas J.* **23**, (16-A), 21.

PRODUCERS MAY TURN FROM MEXICO TO VENEZUELA.—W. P. Buckley. *Oil and Gas J.* **23**, (16-A), 82.

TONKAWA DEEP SAND PUZZLES OPERATORS.—C. D. Lockwood. *Oil and Gas J.* **23**, (16-A), 25.

WORLD'S PETROLEUM CONSUMPTION BY COUNTRIES DURING YEAR 1923.—H. S. Fox. *Oil and Gas J.* **23**, (16-A), 117.

RAPID DEVELOPMENT OF VENEZUELAN OIL.—C. E. Kern. *Oil and Gas J.* **23**, (18-A), 24.

OIL INDUSTRY'S ASSETS $9,250,000,000.—C. E. Bowles. *Oil and Gas J.* **23**, (18-A), 32.

OIL EQUIPMENT IS WORTH $8,350,000,000.—C. E. Bowles. *Oil and Gas J.* **23**, (19-A), 44.

YOUNGEST OIL FIELD IN LOUISIANA.—H. W. Bell and M. W. Grimm. *Oil and Gas J.* **23**, (21-A), 62.

NEW MENACE OF CROMWELL AND PAPOOSE.—C. D. Lockwood.—*Oil and Gas J.* **23**, (22-A), 20.

SMACKOVER FIELD HAS BIG POSSIBILITIES.—W. M. Hauser. *Oil and Gas J.* **23**, (22-A), 59.

PETROLEUM PRODUCTION IN ECUADOR. TRADE AND ECONOMIC REVIEW FOR 1923.—*Ecuador Commerce Rept. Oil Engineering and Finance* **5**, 606.

TONKAWA, OKLAHOMA.—G. Howell. *Oil Engineering and Finance* **5**, 613.

THE PETROLEUM INDUSTRY OF PERU.—*U.S. Commerce Rept. Petr. Times* **12**, 776.

ARGENTINA LARGEST SOUTH AMERICAN PRODUCER.—*U.S. Commerce Repts. Oil Trade* **15**, (10), 96.

THE PETROLEUM INDUSTRY OF RUSSIA.—W. O. Otis. *Trade Information Bull.* 263.

THE OILFIELDS OF VENEZUELA.—M. O'Shaughnessy. *Petr. Times* **12**, 801, 845.

INDIA NEXT TO CHINA AS MARKET FOR OIL.—*U.S. Commerce Rept. Oil and Gas J.* **23**, (20-A), 196.

PETROLEUM AND NATURAL GAS.—D. T. Day. *Mineral Ind.* **32**, 470. *Chem. Abstr.* **18**, 3472.

THE NATIONAL NAPHTHA WELLS OF GBELY IN SLOVAKIA (1913–1922).—E. Schnabel. *Petroleum* **20**, 835. *Chem. Abstr.* **18**, 3472.

TONKAWA FIELD STILL SOURCE OF MYSTERY.—C. D. Lockwood. *Oil and Gas J.* **23**, (23-A), 29.

SOUTH VERNON POOL CAUSES EXCITEMENT.—C. D. Lockwood. *Oil and Gas J.* **23**, (24-A), 23.

GROWING IMPORTANCE OF SOUTH AMERICA.—M. M. Taylor. *Oil and Gas J.* **23**, (24-A), 32.

COLORADO MAKES NEW CLAIMS FOR FAME AS AN OIL PRODUCER.—R. H. Richards. *Oil Trade* **15**, (11), 17.

THE OIL FIELD OF TARANAKI PROVINCE, NEW ZEALAND.—F. G. Clapp. *Nat. Petr. News* **16**, (10), 40.

REVIEW OF PETROLEUM INDUSTRY IN 1923 IN EUROPE, ASIA AND AFRICA. H. C. Morris. *Nat. Petr. News* **16**, (10), 67.

COLORADO'S WILDCATTING HISTORY FAILS TO DISCOUNT STATE'S IMPORTANCE.—T. R. Ingram. *Nat. Petr. News* **16**, (11), 89.

VENEZUELAN OPERATIONS IN 1923 BROUGHT SEVERAL IMPORTANT DEVELOPMENTS.—E. B. Hopkins, C. W. Washburne and H. J. Wasson. Am. Inst. Min. and Met. Engrs. *Nat. Petr. News* **16**, (12), 67.

CROMWELL POOL IS SEMINOLE COUNTY'S LATEST IMPORTANT FIELD.—A. F. Hinton. *Nat. Petr. News* **16**, (13), 17.

LULING FIELD CONDITIONS APPROXIMATE MEXICO ON SMALLER SCALE.—P. Wagner. *Nat. Petr. News* **16**, (14), 77.

SMALL PRODUCING AND REFINING INDUSTRY IN ECUADOR CONFINED TO COAST AREA.—J. H. Sinclair. *Nat. Petr. News* **16**, (15), 99.

THE WORLD'S PETROLEUM PRODUCTION IN 1924.—V. R. Garfias. *Petr. World* **21**, 512.

OIL PROSPECTS ARE POOR IN EUROPE.—H. S. Fox. *Oildom* (*Daily*) **15** (July 29), 1.

WORLD'S PETROL PRICES.—Amer. Dept. of Commerce. *Petr. World* **21**, 404.

3. DRILLING AND FIELD OPERATIONS.

FIELD BOILER DESERVES CLOSE ATTENTION.—H. Pennington. *Oil Weekly* **34**, (11), 37; (12), 29.

HANDLING HIGH PRESSURE IN DEEP FIELDS.—A. J. Mason. *Oil Weekly* **34**, (11), 46.

MECHANICAL CONTROL OF HIGH PRESSURE WELLS REVIEWED.—C. O. Sprenger. *Oil Trade* **15**, (9), 30.

STIMULATING OIL YIELDS IN OIL WELLS.—*U.S. Bureau Mines Repts. Investigations* 2612. *Petr. Times* **12**, 608.

CONSISTENT WORK ON WATER PROBLEMS IN EL DORADO KEEPS FIELD PRODUCING.—L. E. Smith. *Nat. Petr. News* **16**, (37), 87.

DEVELOP METHOD OF CLEANING WELLS WITH AIR.—G. Triplett. *Oil Weekly* **34**, (12), 25.

HISTORY OF PIPE HAS VALUABLE SIDELIGHTS.—F. G. D. Muller. *Oil Weekly* **34**, (12), 35.

GASOLINE ENGINE MAKES HOLE ECONOMICALLY.—W. L. Sloan. *Oil Weekly* **34**, (12), 59.

MAKING OIL WELLS PAY AT GOOSE CREEK.—A. R. McTee. *Oil Weekly* **34**, (13), 27.

SEPARATION OF HEAVY OILS FROM FINE OR SOFT SANDS.—M. E. Layne, Layne and Bowler Corporation, 900, Santa Fe Avenue, Los Angeles.

RECORD TIME MADE IN DRILLING BURBANK WELL.—D. W. Moore. *Oil Trade J.* **15**, (6), 29.

LONG STROKE PUMPS FOR OIL WELLS.—G. R. Taaffe. *Oil Trade J.* **15**, (6), 36.

OIL LEASES AND THE COMMENCEMENT OF DRILLING.—A. W. Gray. *Oil Trade J.* **15**, (6), 47.

SAFETY DEVICES SOUGHT FOR BURSTING BRAKE FLANGES.—C. O. Sprenger. *Oil Trade J.* **15**, (6), 68.

CAUSES AND PREVENTIVES OF CASING COLLAPSE.—H. Pennington. *Oil Weekly* **34**, (8), 28.

DEVELOPMENT OF THE OIL WELL.—E. Timbs. Union Tool Co., Torrance, Calif.

CAREFUL STUDY OF ALL FACTORS REQUIRED IN TAKING CARE OF OIL WELLS.—J. S. Cornell. *Nat. Petr. News* **16**, (40), 63.

ORIGINAL FEATURES IN NEW TYPE OF DERRICK.—*Oil and Gas J.* **23**, (14-A), 66.

FLOODING INCREASES BRADFORD PRODUCTION.—G. Triplett. *Oil Weekly* **35**, (3), 16.

THE "FLOODING" OF OIL SANDS AT BRADFORD.—L. S. Panyity. *Oil Weekly* **35**, (3), 17.

AIR USED TO INCREASE OUTPUT OF WELLS.—G. Triplett. *Oil Weekly* **35**, (3), 24.

DETERMINING CORE BARREL SAMPLES.—A. C. Rubel. *Oil and Gas J.* **23**, (16-A), 114. *Oil Weekly* **35**, (1), 55. *Petr. Times* **12**, 731. *Oil News* **16**, 412, 434.

CRUDE OIL PRODUCTION AND THE ENGINEER.—W. A. W. Krebs. *Oil and Gas J.* **23**, (18-A), 21.

DEVELOPMENT OF DRILLING METHODS.—R. T. Baker. *Oil and Gas J.* **23**, (19-A), 93.

MECHANICAL TRANSMISSION OF POWER THROUGH CHAINS.—C. R. Weiss. *Petr. Times* **12**, 752.

STANDARDISATION OF FIELD EQUIPMENT.—C. A. Young. *Nat. Petr. News* **16**, (42), 66.

WILL AMERICA COME TO MINING FOR OIL?—W. A. J. M. van W. von der Gracht. *Oil and Gas J.* **23**, (22-A), 25.

OIL FIELD FRANCE REGAINED IN WAR IS BEING CAREFULLY TREASURED.—P. A. Ehrhardt. *Oil and Gas J.* **23**, (22-A), 25.

WELLS AT SANTA FE SPRINGS ARE BEING SWABBED.—W. E. Green. *Oil Weekly* **35**, (6), 43.

CEMENTING WELLS FOR SHUTTING OFF WATER.—H. R. Berry. *Petr. Times* **12**, 809.

PETROLEUM ACCIDENTS OF OKLAHOMA.—H. C. Fowler. *Oil and Gas J.* **23**, (20-A), 220.

AIR PUMPING POWER IN BRADFORD DISTRICT.—G. Triplett. *Oil Weekly* **35**, (5), 19.

KNOWLEDGE OF STEEL NECESSARY IN FIELD.—W. W. Wilson. *Oil Weekly* **35**, (5), 20.

SOME EXAMPLES OF INGENUITY ON THE LEASE.—A. R. McTee. *Oil Weekly* **35**, (5), 23.

Sand Traps Reduce Wear on Pump Parts.—H. Pennington. *Oil Weekly* **35**, (5), 24.

Unique Method of Mining Oil in Texas gaining Interest of Operators. —L. E. Smith. *Nat. Petr. News* **16**, (44), 33.

Fluid Recovery from Oil and Gas Wells.—S. C. Herold. *Oil and Gas J.* **23**, (23-A), 21.

Agreement on Standardisation is now Awaiting Application.—L. M. Fanning. *Oil and Gas J.* **23**, (24-A), 62.

Oil Field Standardisation Work big Institute Accomplishment.— V. B. Guthrie. *Nat. Petr. News* **16**, (45), 31.

New Method of Producing Oil is given First Test in Jacksboro Field. —L. E. Smith. *Nat. Petr. News* **16**, (45), 63.

A New Method of Pumping Oil Wells now Used in South-east Ohio. —J. O. Lewis. *Nat. Petr. News* **16**, (8), 53.

Compressed Air Gives Satisfactory Results in Cleaning out Wells. —J. O. Lewis. *Nat. Petr. News* **16**, (9), 61.

An Estimate of the Effect of Vacuum on the Production of Oil.— A. B. Morris. *Nat. Petr. News* **16**, (9), 91.

Oil Companies show Saving by Carrying own Liability Risks.—J. C. Chatfield. *Nat. Petr. News* **16**, (12), 21.

Long Stroke, Slow Motion Pumps used successfully in Oklahoma.— A. F. Hinton. *Nat. Petr. News* **16**, (12), 91.

Safety Work of Oil Industry Spreading on Pacific and in Mid-Continent.—P. Wagner. *Nat. Petr. News* **16**, (17), 53.

Designing of Oil Well Equipment with Safety Features.—E. Timbs. *Nat. Petr. News* **16**, (17), 61.

Oklahoma's Deepest Well Establishes Several Drilling Records.— C. I. O'Neill. *Nat. Petr. News* **16**, (17), 83.

Estimating Underground Oil Reserves.—W. W. Cutler. *U.S. Bureau Mines Bull.* 228. *Petr. Times* **12**, 851.

Effect of Back Pressure on Wells in Brook Field.—J. M. Lovejoy. *Trans. Am. Inst. Min. and Met. Eng.* No. 1292-P.

Mechanical Control of Oil Wells Flowing under High Pressure.— A. J. Mason. *Monthly Chapter Ninth Annual Report, State Oil and Gas Supervisor, Calif. State Mining Bureau* (April), 5.

Mechanical Transmission of Power through Chains Constant Problem of Oil Industry.—C. R. Weiss. *Calif. Oil World* **17** (Aug. 21), 2.

Determining the Constants of Oil-production Curves.—H. M. Roeser. *Trans. Am. Inst. Min. and Met. Eng.* No. 1347-P.

Sturdy Base makes Pump Power Efficient.—A. R. McTee. *Oil Weekly* **35**, (3), 43.

Gas Engine Gaining Favour around Bradford.—G. Triplett. *Oil Weekly* **35**, (3), 49.

PATENTS.

WELL SCREEN AND METHOD OF MAKING SAME.—M. E. Layne. U.S. Pat. 1,500,828. *Nat. Petr. News* **16**, (26), 90.

APPARATUS FOR AND METHOD OF CEMENTING OIL-WELL CASINGS.—E. V. Crowell. U.S. Pat. 1,502,179. *Nat. Petr. News* **16**, (36), 91.

METHOD OF AND APPARATUS FOR REMOVAL OF FLUIDS FROM WELLS.—I. L. Dunn. U.S. Pat. 1,499,509. *Nat. Petr. News* **16**, (36), 91.

4. PIPE LINES, TRANSPORT AND STORAGE.

THE NEW IMPORTANCE OF EVAPORATION.—C. P. Buck. *Oil Trade J.* **15**, (9), 34. *Chem. Abstr.* **18**, 3473.

RESULTS OF TESTS OF EVAPORATION LOSS FROM FIELD STORAGE TANKS.—H. T. Morley. *Min. and Met.* (Aug.). *Nat. Petr. News* **16**, (34), 53. *Chem. Abstr.* **18**, 3472.

INDUSTRY HAS ITS OWN TRANSPORTATION.—R. T. Baker. *Oil and Gas J.* **23**, (19-A), 244.

HOW TO FIND THE CONTENTS OF HORIZONTAL STORAGE TANKS.—J. B. Reynolds and S. Cottrell. *Chem. and Met. Eng.* **31**, 665.

FIRE PREVENTION IN OIL PROPERTIES.—F. A. Epps. *Oil and Gas J.* **23**, (21-A), 32. *Nat. Petr. News* **16**, (41), 32.

DANGER OF IGNITION OF INFLAMMABLE LIQUIDS (VARNISH SOLVENTS) THROUGH ELECTRICAL EXCITATION.—D. Holde. *Farben Zeit.* **40**, 1891. *J. Soc. Chem. Ind.* **43**, B898.

WHO'S WHO IN PIPE LINE TRANSPORTATION.—C. E. Bowles. *Oil and Gas J.* **23**, (22-A), 28.

THWARTING THE UNSEEN THIEF (PETROLEUM EVAPORATION).—J. H. Wiggins. *Petr. Age* **14**, (4), 16. *Chem. Abstr.* **18**, 3472.

EXTINGUISHING OIL FIRES BY USING LIQUID CARBON DIOXIDE.—W. H. Freygang. *Oil and Gas J.* **23**, (12-A), 86. *Chem. Abstr.* **18**, 3473.

WHO'S WHO IN TANK CARS AND TANKERS.—C. E. Bowles. *Oil and Gas J.* **23**, (23-A), 28.

ELECTRIC WELDING OF LARGE STORAGE TANKS.—H. C. Price. *Trans. Am. Inst. Min. and Met. Eng.* No. 1345-P.

PATENT.

OIL STORAGE TANKS.—C. A. Stanley. U.S. Pat. 1,502,924. *Chem. Abstr.* **18**, 2960.

5. REFINERY TECHNIQUE.

THE ELECTRICAL PROCESS FOR THE DEHYDRATION OF CRUDE OIL EMULSIONS.—A. J. Houston. *Petr. World* **21**, 424.

CATALYTIC TREATMENT OF CRACKED DISTILLATES IN THE VAPOUR PHASE.—T. T. Gray and M. R. Mandelbaum. *Ind. and Eng. Chem.* **16**, 913. *Petr. Times* **12**, 524. *J. Soc. Chem. Ind.* **43**, B857. *Chem. Abstr.* **18**, 3473.

THE PRODUCTION OF STABLE NATURAL GASOLINE.—E. H. Leslie. *Oil News (U.S.A.)* **12**, (7), 13. *Chem. Abstr.* **18**, 2956.

DISTILLING CRUDE OIL UNDER REDUCED PRESSURE.—G. Triplett. *Ref. and Nat. Gas. Mfr.* **3**, (7), 11. *Chem. Abstr.* **18**, 2957.

CALIFORNIA DEVELOPMENT IN THE PREPARATION AND USE OF ADSORPTIVE CLAYS IN REFINING.—C. J. von Bibra. *R. and Nat. Gas. Mfr.* **3**, (7), 15. *Petr. World* **21**, 359. *Chem. Abstr.* **18**, 2958.

RECENT PROGRESS IN INSECTICIDES AND FUNGICIDES.—C. C. McDonnell. *Ind. and Eng. Chem.* **16**, 1007.

SILICA GEL.—J. H. Frylender. *Rev. des Prods. Chim.* (Sept. 30). *Chem. Trade J.* **75**, 453.

NEW VACUUM REFINING PROCESS MAKES NARROW CUT LUB OILS.—P. Truesdell. *Nat. Petr. News* **16** (37), 64.

TESTS ON THE USE OF SODIUM CARBONATE INSTEAD OF SODIUM HYDROXIDE FOR THE PURIFICATION OF KEROSENE.—V. Gurvitch. *Azerbraidj. Neft. Choz.* **111**, 90. *Chim. et Ind.* **12**, 71. *Chem. Abstr.* **18**, 3111.

WISSENSCHAFTLICHE GRUNDLAGEN DER ERDÖLVERARBEITUNG.—L. Gurwitsch. J. Springer, Berlin.

BAUXITE AS A PURIFYING AGENT FOR PETROLEUM DISTILLATION PRODUCTS.—A. Guiselin. *Chim. et Ind.* **12**, 423.

SEPARATION OF WAX FROM WAX DISTILLATE.—L. D. Wyant. *Nat. Petr. News* **16**, (40), 73. *Oil and Gas J.* **23**, (19-A), 224.

METHODS OF MANUFACTURING LUBRICANTS.—R. T. Baker. *Oil and Gas J.* **23**, (18-A), 108.

THE REFINING AND RECOVERY OF PETROLEUM PRODUCTS WITH SILICA GEL.—E. B. Miller. *Trans. Am. Inst. Chem. Ind.* **15**, I., 241. *Chem. Abstr.*, **18**, 3268.

METHODS OF CLEANING PRESSURE TUBE STILLS DESCRIBED BY ELLIOTT OFFICIAL.—F. H. Penberthy. *Ref. and Nat. Gas. Mfr.* **3**, (10), 44.

PRODUCING WAX AND LARD BY MECHANICAL REFRIGERATION.—H. J. MACINTIRE. *Chem. and Met. Eng.* **31**, 699.

NEARLY PERFECT GASOLINE PRODUCED AT RICHFIELD REFINING PLANT.—C. O. Sprenger. *Oil Trade J.* **15**, (10), 56.

FRACTIONAL DISTILLATION FOR THE SEPARATION OF THE CONSTITUENTS OF PETROLEUM.—W. A. Peters. *Ind. and Eng. Chem.* **16**, 1126.

SILICA GEL AS AN ADSORPTION AGENT, PARTICULARLY IN THE REFINING OF PETROLEUM.—R. Koetschau. *Chem. Zeit.* **43**, 497, 518. *Petr. Times* **12**, 268. *Chem. and Met. Eng.* **31**, 356. *Chem. Abstr.* **18**, 3440. *Ind. and Eng. Chem.* **16**, 1090.

EFFICIENT SAFETY ORGANISATION PLAN.—W. W. Winslow. *Oil and Gas J.* **23**, (23-A), 84.

ACCIDENT PREVENTION EXPLAINED BY NEW JERSEY STANDARD EXPERT.—E. C. Timm. *Oil and Gas J.* **23**, (23-A), 84.

CONTROLLING VOLUMES AND TEMPERATURES IN REFINING OPERATIONS.—H. S. Bell. *Nat. Petr. News* **16**, (8), 71.

THE INDEPENDENT REFINER: HIS PAST, PRESENT AND FUTURE.—H. G. James. *Nat. Petr. News* **16**, (11), 43.

REFINERY HEAT LOSSES AND INSULATION-STILLS AND SETTINGS.—H. S. Bell. *Nat. Petr. News* **16**, (13), 62.

CUTTING DOWN HEAT LOSS BY PROPER STEAM LINE INSULATION.—H. S. Bell. *Nat. Petr. News* **16**, (14), 93.

ADSORPTION AS APPLIED TO REFINING OF PETROLEUM PRODUCTS.—H. L. Kauffman. *Nat. Petr. News* **16**, (15), 55; (16), 133.

NATURAL GASOLINE: ITS PLACE IN THE STRAIGHT RUN REFINERY.—W. K. Holmes. Convention of the Assn. of Natural Gasoline Mfrs. *Nat. Petr. News* **16**, (17), 64.

PATENTS.

METHOD OF MAKING A HYDROCARBON OIL.—T. L. Kerr and K. Kelley. U.S. Pat. 1,503,792. *Ref. and Nat. Gas. Mfr.* **3**, (9), 36. *Chem. Abstr.* **18**, 2960.

PROCESS FOR PURIFYING HYDROCARBON OILS.—F. W. Manning, Assgr. to Manning Refining Equipment Corp. U.S. Pat. 1,504,772. *Ref. and Nat. Gas. Mfr.* **3**, (9), 36. *Chem. and Met. Eng.* **31**, 432. *J. Soc. Chem. Ind.* **43**, B821. *Chem. and Met. Eng.* **31**, 432. *Nat. Petr. News* **16**, (42), 112.

APPARATUS FOR TREATING OILS.—H. T. Maitland, assgr. to Sun Oil Co. U.S. Pat. 1,505,479. *Ref. and Nat. Gas. Mfr.* **3**, (9), 36. *J. Soc. Chem. Ind.* **43**, B822.

BREAKING OIL EMULSIONS.—C. V. Zoul. U.S. Pat. 1,501,877. *J. Soc. Chem. Ind.* **43**, B779. *Chem. Abstr.* **18**, 2960. *Nat. Petr. News* **16**, (36), 90. *J. Soc. Chem. Ind.* **43**, B779.

TREATING OIL SAND.—W. McArthur. U.S. Pat. 1,502,261. *Chem. Abstr.* **18**, 2960. *J. Soc. Chem. Ind.* **43**, B821.

METHOD FOR SEPARATING MIXTURES OF LIQUIDS.—E. I. Dyer and A. R. Heise. Reissue U.S. Pat. No. 15,871. *Nat. Petr. News* **16**, (36), 90.

PURIFYING AND DEODORISING ISOPROPYL ALCOHOL.—M. D. Mann, Assr. to S. B. Hunt. U.S. Pat. 1,502,149. *J. Soc. Chem. Ind.* **43**, B890.

ISOPROPYL ALCOHOL.—H. E. Buc. U.S. Pat. 1,498,229. *Chem. Abstr.* **18**, 3194. *J. Soc. Chem. Ind.* **43**, B732.

CENTRIFUGAL SEPARATIONS OF WAX FROM MINERAL OIL LUBRICATING STOCK OR SIMILAR MATERIALS.—J. W. Weir. U.S. Pat. 1,505,453. *Chem. Abstr.* **18**, 3270.

REMOVING COLLOIDAL ASPHALT FROM CRUDE PETROLEUM.—R. N. Donaldson and R. McCollum, assgd. to Standard Oil Co. U.S. Pat. 1,506,115. *Chem. Abstr.* **18**, 3270. *Nat. Petr. News* **16**, (42), 113. *J. Soc. Chem. Ind.* **43**, B899.

METHOD OF BLEACHING PETROLEUM PRODUCTS WITH CLAY.—C. W. Stratford. U.S. Pat. 1,508,625. *J. Soc. Chem. Ind.* **43**, B900. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39.

PROCESS OF TREATING LIGHT HYDROCARBON DISTILLATES.—F. H. Smith and G. J. Ziser, Assgrs. to Standard Oil Co. U.S. Pat. 1,507,692. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39. *Chem. Abstr.* **18**, 3475.

PROCESS FOR LOWERING THE COLD TEST OF LUBRICATING OILS.—J. W. Weir and W. J. Ryan. U.S. Pat. 1,509,325. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39.

PROCESS OF TREATING MINERAL LUBRICATING OILS CONTAINING WAX.—J. W. Weir. U.S. Pat. 1,509,326. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39.

METHOD OF REFINING HYDROCARBONS.—V. L. Oil Processes Co., O. D. Lucas and E. L. Lomax. Brit. Pat. 223,066. *Chem. Abstr.* **18**, 503.

ALKYL AND ARYL LEAD COMPOUNDS.—General Motors Research Corpn. Brit. Pat. 216,083. *Chem. Abstr.* **18**, 3386.

PREVENTING EMULSIFICATION OF WATER WITH MINERAL OILS, ETC.—Sharples Specialty Co. Brit. Pat. 215,929. *Chem. Abstr.* **18**, 3475.

DISTILLING MATERIALS IN CONTACT WITH POROUS SUBSTANCES.—B. Gallsworthy, Assgd. to The Texas Co. U.S. Pat. 1,477,642. *Nat. Petr. News* **16**, (4), 77.

PURIFYING HYDROCARBONS.—T. T. Gray. Brit. Pat. 222,481. *Chem. Age* **11**, 560.

6. NATURAL GAS.

CARBON BLACK FROM GAS IN 1923.—U.S. Geol. Surv. *Chem. and Met. Eng.* **31**, 467. *Oil Paint and Drug Repr.* **106**, (11), 29.

NATURAL GAS OF ALBERTA.—Rept. of Scient. Industrial Research Council of Alberta. *Oil News* **16**, 376.

CHARCOAL PLANT SHOWS GOOD YIELD.—R. C. Alden. *Ref. and Nat. Gas. Mfr.* **3**, (9), 13.

SOLID AND LIQUID IMPURITIES IN NATURAL GAS AND MEANS FOR THEIR REMOVAL.—Natural Gas Committee of the Pacific Coast Gas Assocn. *Natural Gas* **5**, (5), 22. *Chem. Abstr.* **18**, 2954.

UTILISATION OF NATURAL GAS IN 1922.—H. J. Struth. *Natural Gas* **5**, (2), 32. *Chem. Abstr.* **18**, 2954.

NATURAL GAS IN ALBERTA.—R. T. Elworthy. *Canada Dept. Mines. Mines Branch Rept. Nat. Petr. News* **16**, (38), 52.

NON-INFLAMMABLE GAS RUNS STEAM ENGINE.—H. H. King. *Oil Weekly* **35**, (3), 21.

CANADA IS SECOND IN NATURAL GAS.—R. T. Elworthy. *Oil and Gas J.* **23**, (16-A), 62.

DEVELOPMENT OF NATURAL GASOLINE.—C. O. Willson. *Oil and Gas J.* **23**, (19-A), 240.

THE RARE GASES OF NATURAL GAS.—C. Moureu. *Comptes rend.* **178**, 1945. *Chem. Abstr.* **18**, 3129.

HELIUM FUTURE FIELD FOR GAS INDUSTRY.—C. E. Kern. *Oil and Gas J.* **23**, (21-A), 24.

CARBON BLACK PRODUCED FROM NATURAL GAS.—G. B. Richardson. U.S. Geol. Surv. *Oil and Gas J.* **23**, (22-A), 62.

CARBON BLACK OUTPUT INCREASES 104 PER CENT.—U.S. Geol. Surv. *Oil Trade J.* **15**, (10), 40.

THERMAL DECOMPOSITION OF METHANE.—R. C. Cantelo. *J. Phys. Chem.* **28**, 1036. *J. Soc. Chem. Ind.* **43**, B931.

NATURAL GASOLINE COLOUR AFFECTED BY COMPRESSOR LUBRICATION.—O. Peters. *Nat. Petr. News* **16**, (32), 27. *Ref. and Nat. Gas. Mfr.* **3**, (8), 17. *Chem. Abstr.* **18**, 3473.

CHARCOAL ABSORPTION PROCESS.—R. T. Baker. *Oil and Gas J.* **23**, (12-A), 108. *Chem. Abstr.* **18**, 3474.

PATENTS.

APPARATUS FOR SEPARATING CONSTITUENTS OF GASEOUS MIXTURES BY ADSORPTION UNDER PRESSURE.—O. L. Barnebey. U.S. Pat. 1,502,897. *Chem. Abstr.* **18**, 2826.

REMOVAL OF SULPHUR COMPOUNDS FROM GASES FREE FROM AMMONIA.—Farbenfabr. vorm. F. Bayer und Co. Ger. Pat. 298,171. *J. Soc. Chem. Ind.* **43**, B820.

APPARATUS FOR TREATING LIQUIDS WITH GASES.—C. S. Palmer. U.S. Pat. 1,504,265. *Chem. Abstr.* **18**, 3268.

PROCESS OF MAKING GASOLINE FROM NATURAL GAS.—H. E. Thompson, Assgr. to Carbide and Carbon Chemicals Corpn. U.S. Pat. 1,507,634. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39. *Chem. Abstr.* **18**, 3476.

PROCESS OF EXTRACTING GASOLINE FROM NATURAL GAS.—G. M. Turner. U.S. Pat. 1,510,353. *Ref. and Nat. Gas. Mfr.* **3**, (10), 40.

APPARATUS FOR USING ABSORBING LIQUIDS TO EXTRACT CASINGHEAD GASOLINE FROM NATURAL GAS.—G. M. Turner. U.S. Pat. 1,510,354. *Ref. and Nat. Gas. Mfr.* **3**, (10), 40.

RECOVERY OF GASOLINE FROM GAS.—F. E. Hosmer. U.S. Pats. 1,510,433–4. *Ref. and Nat. Gas. Mfr.* **3**, (10), 40.

CARBON BLACK.—G. C. Lewis, Assgd. to Columbian Carbon Co. U.S. Pat. 1,510,485. *Chem. and Met. Eng.* **31**, 709.

PROCESS FOR OBTAINING SULPHUR FROM GAS CONTAINING HYDROGEN SULPHIDE.—Farbenfabr. vorm. F. Bayer und Co. Brit. Pat. 207,196.

Oxidising Hydrogen Sulphide.—H. Carstens, A. Engelhardt and W. J. Müller. U.S. Pat. 1,507,105. *Chem. Abstr.* **18**, 3458.

Carbon Black.—C. Matlock, Assr. to Monroe-Louisiana Carbon Co. U.S. Pat. 1,508,367. *Chem. Abstr.* **18**, 3458. *J. Soc. Chem. Ind.* **43**, B953.

Method of Recovering Gasoline.—L. V. Warren. U.S. Pat. 1,484,922. *Nat. Petr. News* **16**, (14), 125.

Method of Treating Natural-gas Gasoline and of Making Gas therefrom.—A. N. Kerr. U.S. Pat. 1,482,933. *Nat. Petr. News* **16**, (14), 125.

7. Petrol and other Motor Fuels.

Fresh Light on Ethyl Gas.—L. J. Livshis. *Petr. Age* **14**, (9), 13.

The Problem of the National Carburetant.—G. Baume. *Ann. chim. anal. chim. appl.* **6**, 136. *Chem. Abstr.* **18**, 2953.

Solubility of Gasoline (Hexane and Heptane) and Benzene in Water at 25°.—L. H. Milligan. *J. Phys. Chem.* **28**, 494. *J. Soc. Chem. Ind.* **43**, B818.

Notes on British Standard Motor Spirit.—Brit. Eng. Standard Assoc. *Oil Engineering and Finance* **5**, 575.

Petrol Mixtures and Efficiency of Benzol.—R. W. A. Brewer. *Oil Engineering and Finance* **5**, 577.

Determination of Gas Distribution in Internal-combustion Engines by Gas Analysis.—G. W. Jones, W. P. Yant and L. B. Berger. *U.S. Bureau Mines Repts. Investigations* 2631.

"Dynalkol," the National Liquid Fuel of Czechoslovakia.—C. Petrlik. *Chim. et Ind.* **11** (Special No.), 281. *Chem. Abstr.* **18**, 3106.

Combustion of Fuels in Internal-combustion Engines.—W. Ostwald. *Auto-Tech.* **13**, 9. *Chem. Abstr.* **18**, 3107.

Bench Tests of Mixtures of Alcohol and Heavy Gasolines.—O. W. Watson and W. R. Ormandy. *Chim. et Ind.* **11** (Special No.), 276. *Chem. Abstr.* **18**, 3107. *J. Soc. Chem. Ind.* **43**, B856.

Tenth Semi-Annual Motor Gasoline Survey.—N. F. Le Jeune and B. A. Landry. *U.S. Bureau Mines Repts. Investigations* 2636. *Petr. World* **21**, 476. *Petr. Age* **14**, (7), 26. *Petr. Times* **12**, 528.

Midgely Talks on Ethyl Gas before Automotive Engineers.—*Oil Paint and Drug Repr.* **106**, (15), 80.

Character of Gasoline Shows Change.—R. T. Baker. *Oil and Gas J.* **23**, (16-A), 116.

Tetralin: Its History, Manufacture and Use as a Fuel for Internal-combustion Engines.—F. Nathan. *Fuel* **3**, 346. *J. Soc. Chem. Ind.* **43**, B897.

Object to Arbitrary Specifications.—R. T. Baker. *Oil and Gas J.* **23**, (22-A), 86.

THE PRESENT POSITION OF GASOLINE.—J. E. Hackford. *Oil Engineering and Finance* **5**, 626.

LES COMBUSTIBLES LIQUIDES ET LE PROBLÈME DU CARBURANT NATIONAL.—M. Aubert. Gauthiers-Villars et Cie., Paris.

FRENCH GASOLINE SUBSTITUTE PLAN FAILS.—*U.S. Commerce Repts. Oil Trade J.* **15**, (10), 50.

TETRAETHYL LEAD IN GASOLINE MANUFACTURE.—U.S. Bureau Mines Rept. *Petr. Times* **12**, 830. *Chem. and Met. Eng.* **31**, 750. *Oil and Gas J.* **23**, (24-A), 107. *Nat. Petr. News* **16**, (45), 25. *Chem. Age* **11**, 553.

CATALYSIS AND THE INTERNAL COMBUSTION ENGINE.—E. Sokal. *J. Soc. Chem. Ind.* **43**, 283 T. *Chem. Abstr.* **18**, 3465.

CONTRIBUTIONS À LA THEORIE DES MOTEURS À COMBUSTION INTERNE.—Gauthier-Villars et Cie., Paris.

LIMITATIONS OF END POINT SPECIFICATION FOR GASOLINE.—R. O. and H. B. Neal. *Nat. Petr. News* **16**, (15), 123.

ASSOCIATION OF NATURAL GASOLINE MANUFACTURERS: NEW SPECIFICATIONS ADOPTED.—*Petr. Times* **12**, 854. *Nat. Petr. News* **16**, (40), 40. *Oil and Gas J.* **23**, (19-A), 270. *Ref. and Nat. Gas. Mfr.* **3**, (10), 11. *Oil Trade J.* **15**, (11), 62.

CAR CARBURETION REQUIREMENTS.—C. S. Kegerreis and O. Chenoweth. Bull. Purdue University Eng. Dept. **8**, (May).

Patents.

MOTOR FUEL.—D. O. White. U.S. Pat. 1,501,383. *J. Soc. Chem. Ind.* **43**, B822.

METHOD OF BLENDING GASOLINE.—T. L. Kerr and K. Kelley. U.S. Pat. 1,503,792. *Nat. Petr. News* **16**, (42), 112.

LIQUID FUEL FOR INTERNAL-COMBUSTION ENGINES.—Badische Anilin-und Soda Fabrik. Brit. Pat. 215,776. *Chem. Abst.* **18**, 3471.

PRODUCTION OF LIQUID MOTOR FUELS.—K. Kelley and T. L. Kerr. U.S. Pat. 1,480,808. *Nat. Petr. News* **16**, (8), 77.

PROCESS FOR THE PRODUCTION OF LIQUID-FUEL MIXTURES CONTAINING ALCOHOL.—P. Loriette. Brit. Pat. 188,336.

8. KEROSENE.

"WHITE SPIRIT."—E. Sauvage. *Chim. et Ind.* **11**, (Spec. No.), 273. *Chem. Abstr.* **18**, 3117.

Patents.

INSECTICIDE.—A. T. Wilson. Can. Pat. 242,134. *Chem. Abstr.* **18**, 3447.

LIQUID FUEL MIXTURE.—Z. Olsson. U.S. Pat. 1,507,619. *Chem. Abstr.* **18**, 3470.

10. Lubricants and Lubrication.

Plant and Materials Employed in Chemical Industry: Part V., Greases and Lubricants.—X. Jacodet. *L'Ind. Chim.* (Sept.), 396.

Eastern and Western Lubricating Oils Equally Good as Shown by Highway Commission's Tests.—T. E. Stanton. *Petr. World (Calif.)* **9**, (7), 25. *Chem. Abstr.* **18**, 2957.

Turbine Lubrication.—N. E. Funk. *Ind. and Eng. Chem.* **16**, 1080.

"Lubs": Their History, Manufacture and Function.—W. Miller. *Oil Trade J* **15**, (9), 28, (11), 58.

Lubricants.—F. Hoyer. *Der Apparatebau*, **36**, 163.

Steam Turbines and Their Proper Lubrication.—A. L. Nugey. *Oil Trade J.* **15**, (6), 50.

Water-Soluble "Drilling" Oils.—H. von der Heyden and K. Typke *Chem. Zeit.* **48**, 571. *J. Soc. Chem. Ind.* **43**, B877.

Lubricating Greases.—A. Dubosc. *Mat. Grasses* **16**, 6874. *Chem. Abstr.* **18**, 3268.

Engine Oil Consumption and Dilution.—N. MacCoull. *J. Soc. Auto. Eng.* **15**, 93. *Chem. Abstr.* **18**, 3269.

A Possible Solution of the Crank Case Oil Dilution Problem.—I. L. Anderson. *J. Soc. Auto. Eng.* **15**, 43. *Chem. Abstr.* **18**, 3269.

Factors Affecting the Rate of Crank-Case Oil Dilution.—J. O. Eisinger. *J. Soc. Auto. Eng.* **15**, 69. *Chem. Abstr.* **18**, 3269.

Water in Crank-Case Oils.—A. L. Clayden. *J. Soc. Auto. Eng.* **15**, 47. *Chem. Abstr.* **18**, 3269.

The Value and Utilisation of the Characteristic Properties of Lubricating Oils.—Piesseveaux. *Rev. universelle mines* [7], **3**, 153. *Chem. Abstr.* **18**, 3475.

Selection of Marine Oils.—J. B. Rathbun. *Petr. Age* **14**, (8), 56.

Choosing Metal Cutting Oil.—J. B. Rathbun. *Petr. Age* **14**, (7), 80.

Light on Crank Case Oils.—J. B. Rathbun. *Petr. Age* **14**, (9), 64.

Patent.

Preparation of Neutral, Solid Colloids and Lubricating Greases.—Chem. Werkstatten G.m.b.H. Ger. Pat. 398,879. *J. Soc. Chem. Ind.* **43**, B822.

11. Fuel Oil.

Supplying Proper Domestic Fuel.—C. E. Doud. *Oil Trade J.* **15**, (9), 70.

Pressure, Temperature and Air in Burning Oil Efficiently.—A. L. Wernert. *Oil and Gas J.* **22**, (16-A), 84.

LIQUID FUEL FOR DOMESTIC HEATING.—C. E. Bowles. *Oil and Gas J.* **23**, (19-A), 110.

LIQUID FUEL.—N. J. Arnott. *Commonwealth Eng.* **12**, 16 *Chem. Abstr.* **18**, 3465.

SLOW GELATION IN PRESSURE-STILL TAR.—S. E. Sheppard and L. W. Eberlin. *Ind. and Eng. Chem.* **16**, 832. *Chem. Abstr.* **18**, 3470. *J. Soc. Chem. Ind.* **43**, B777.

WHEN FUEL OIL COMPETES WITH COAL.—C. E. Bowles. *Oil and Gas J.* **23**, (23-A), 23.

12. DIESEL OIL AND ENGINES.

HEAVY FUEL FOR DIESEL ENGINES.—R. Hildebrand. *Oil and Gas J.* **23**, (8-A), 92. *Chem. Abstr.* **18**, 2957.

THE SIGNIFICANCE OF EXHAUST TEMPERATURE.—P. H. Smith. Diesel Engine Users Assoc. *Oil News* **16**, 428.

FUELS FOR HEAVY-OIL ENGINES (PETROLEUM AND SHALE OILS).—Brit. Eng. Standards Assoc.

DIESEL AND OIL ENGINEERING HANDBOOK.—J. Rosbloom.

DIESEL MAY REPLACE EXPLOSION MOTOR.—A. Sommer. *Oil and Gas J.* **23**, (23-A), 58.

VARIOUS OIL ENGINE TRIALS AND EXPERIMENTS.—A. I. Nicholson. *Motorship* **8**, 866.

13. PLANT AND MACHINERY.

THE OIL ENGINEER: TUBES, PIPES AND VALVES.—T. Watts-Rockett. *Oil News* **16**, 10, 77, 97, 121, 151, 187, 234, 265, 291, 317, 372, 429, 459, 494, 523, 542, 580, 601.

TOWERS IMPROVE ACCURACY OF FRACTIONATION.—H. Pennington. *Ref. and Nat. Gas. Mfr.* **3**, (9), 15. *Chem. Abstr.* **18**, 3473.

REFINING WITHOUT SHUTDOWN FOR RE-RUN.—G. W. Reid. *Ref. and Nat. Gas. Mfr.* **3**, (9), 27.

TUBE-SECTION TREATING PLANT CUTS OIL RECOVERY COSTS 6 CENTS A BARREL.—P. Wagner. *Nat. Petr. News* **16**, (30), 71.

A NEW DISTILLATION PROCESS FOR CRUDE PETROLEUM.—W. Boormann. *Petroleum. Petr. Times* **12**, 649.

SELF-RELIANCE REQUIRED IN A DOMESTIC OIL BURNER.—A. B. Goodspeed. *Oil Trade J.* **15**, (6), 44.

USING X-RAYS TO DETECT HIDDEN DANGERS IN PLANT EQUIPMENT.—H. H. Lester, E. C. Herthel, W. Mendius and W. V. Ischie. *Chem. and Met. Eng.* **31**, 619.

TEMPERATURE REGULATION OF TOWERS.—W. C. Begeebing. *Oil and Gas J.* **23**, (15-A), 92. *Petr. World* **21**, 399. *Nat. Petr. News* **16**, (36), 67. *Chem. Abstr.* **18**, 3473.

PUMPS ARE ESSENTIAL TO OIL INDUSTRY.—R. T. Baker. *Oil and Gas J.* **23**, (16-A), 21.

FREELAND PROCESS SUCCESSFUL AT BRISTOW.—R. T. Baker. *Oil and Gas J.* **23**, (16-A), 92.

RECTIFICATION OF DILUTED CRANK CASE OIL.—R. L. Skinner. *J. Soc. Auto. Eng.* **15**, 51. *Chem. Abstr.* **18**, 3269.

INDUSTRY'S INSULATING MATERIAL MADE FROM EARTH.—E. A. Phœnix. *Oil Trade J.* **15**, (10), 94.

OIL REFINERY SPECIFICATIONS.—A. L. Nugey. *Chem. and Met. Eng.* **31**, 745.

NEW OIL BURNER PRODUCT OF EIGHT YEARS.—L. M. Fanning. *Oil and Gas J.* **23**, (20-A), 180.

AUTOMATIC APPARATUS FOR METERING AND SAMPLING FLUIDS.—*Koch. Z. Zuckerind. cechoslov. Rep.* **48**, 335. *Chem. Abstr.* **18**, 3296.

COLLOID MILL AID TO PROCESS PLANTS.—W. A. McLean. *Ref. and Nat. Gas. Mfr.* **3**, (8), 29. *Chem. Abstr.* **18**, 3472.

SKIMMING PLANT.—R. T. Baker. *Oil and Gas J.* **23**, (13-A), 84. *Chem. Abstr.* **18**, 3474.

VARIOUS TYPES OF DOMESTIC OIL BURNERS AND HOW THEY OPERATE.—W. J. Ottinger. *Nat. Petr. News* **16**, (4), 67.

JOBBER DESIGNS NOVEL HEATING DEVICE TO UNLOAD ROAD OIL QUICKLY.—W. K. Halbert. *Nat. Petr. News* **16**, (14), 109.

INSULATION OF STILLS: WHAT MAKES IT LONG OR SHORT LIVED.—L. C. Converse. *Nat. Petr. News* **16**, (16), 137.

CONTROLLING VOLUMES AND TEMPERATURES IN REFINING OPERATIONS.—H. S. Bell. *Nat. Petr. News* **16**, (8), 71.

PATENTS.

APPARATUS FOR CONDENSING AND FRACTIONATING HYDROCARBONS.—E. Owen. U.S. Pat. 1,505,798. *Ref. and Nat. Gas. Mfr.* **3**, (9), 36. *J. Soc. Chem. Ind.* **43**, B821. *Oil and Gas J.* **23**, (20-A), 200. *Nat. News* **16**, (42), 112.

APPARATUS FOR INTERCHANGE OF HEAT BETWEEN LIQUIDS.—E. Mortsrud. U.S. Pat. 1,503,428.

METHOD OF EXTRACTING FROM WAX-CONTAINING HYDROCARBONS.—J. W. Weir. U.S. Pat. 1,505,453. *J. Soc. Chem. Ind.* **43**, B822.

DEHYDRATION AND DISTILLATION OF TARS OR OILS.—Thermal, Industrial and Chemical (T.I.C.) Research Co., Ltd., and D. Rider. Brit. Pat. 221,528. *Chem. Age* **11**, 400. *J. Soc. Chem. Ind.* **43**, B934.

PROCESS OF DISTILLING OIL.—J. J. Allinson. U.S. Pat. 1,500,040. *Nat. Petr. News* **16**, (36), 90. *Ref. and Nat. Gas. Mfr.* **2**, (8), 39. *J. Soc. Chem. Ind.* **43**, B779. *Chem. Abstr.* **18**, 2804.

RETORT OR STILL.—F. Lamplough and N. C. T. Harper. *Nat. Petr. News* **16**, (36), 90.

OIL WELL PUMPER.—F. H. Sibley, Assr. to Maximum Power Co. U.S. Pat. 1,502,690. *Nat. Petr. News* **16**, (36), 90.

BIG-SHEAVE CROWN BLOCK.—C. C. Scharpenberg and L. G. Gates, Assrs. to Standard Oil Co., California. U.S. Pat. 1,502,161. *Nat. Petr. News* **16**, (36), 91.

HEAT-EXCHANGE APPARATUS.—W. H. Ripley. U.S. Pat. 1,505,429. *Chem. Abstr.* **18**, 3127.

APPARATUS FOR SEPARATING OIL AND WATER OR OTHER LIQUIDS OF DIFFERENT SPECIFIC GRAVITIES.—H. M. Alexander. U.S. Pat. 1,505,841.

APPARATUS FOR GRAVITY SEPARATION OF DIFFERENT LIQUIDS FROM EACH OTHER.—C. S. Lenz and G. E. Jupp. U.S. Pat. 1,505,791. *Chem. Abstr.* **18**, 3127.

APPARATUS FOR SEPARATING LIQUIDS AND GASES.—A. H. Stebbins. U.S. Pat. 1,505,743-4. *Chem. Abstr.* **18**, 3127.

STEAM-JACKETED APPARATUS FOR DIGESTING AND AGITATING OILS.—H. T. Maitland. U.S. Pat. 1,505,479. *Chem. Abstr.* **18**, 3270.

ELECTRIC HEATER FOR OIL WELLS.—P. F. Brine, Assr. to Oil Wells Renewal Co. U.S. Pat. 1,504,208. *Nat. Petr. News* **16**, (42), 112.

APPARATUS FOR DEHYDRATING MIXTURES OF ALCOHOL AND LIQUID HYDROCARBONS.—Soc. Ricard, Allenet et Cie. Brit. Pat. 204,697 *J. Soc. Chem. Ind.* **43**, B899.

CRYSTALLISING AND SWEATING PARAFFIN.—H. L. Allan, J. Moore and The Burmah Oil Co., Ltd. U.S. Pat. 1,504,923. *Chem. and Met. Eng.* **31**, 393. *Nat. Petr. News* **16**, (42), 112.

IMPROVED OIL WELL PUMP.—C. C. Scharpenberg and L. G. Gates. U.S. Pat. 1,504,081. *Nat. Petr. News* **16**, (42), 112.

WELL-CASING SHOE.—L. F. Baash. U.S. Pat. 1,505,690. *Nat. Petr. News* **16**, (42), 113.

APPARATUS FOR SEPARATING OIL FROM OIL SAND.—N. S. Clarke, Assr. to Athabasca Oil Products, Ltd. U.S. Pat. 1,508,923. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39.

WELLS.—R. Stirling. Brit. Pat. 220,410. *Oil Engineering and Finance* **5**, 640.

BURNERS FOR LIQUID FUEL.—Ateliers H. Cuénod Soc. Anon. Brit. Pat. 201,167.

APPARATUS FOR SEPARATING OIL FROM WATER BY GRAVITY.—W. J. MacArthur and R. E. Maynard. Brit. Pat. 216,089.

OIL WELL HEATER.—R. C. Beck, Assr. to The Cutler-Hammer Mfg. Co. U.S. Pat. 1,477,802. *Nat. Petr. News* **16**, (4), 79.

DEHYDRATOR.—W. Meredith, Assd. to Petroleum Rectifying Co. U.S. Pat. 1,480,091. *Nat. Petr. News* **16**, (8), 77.

Casinghead and Blow-out Preventer.—W. L. Palmer and G. Kammerer. U.S. Pat. 1,479,625. *Nat. Petr. News* **16**, (8), 77.

Apparatus for Melting Paraffin and Base Sediment in Oil Wells.—H. S. Rankin. U.S. Pat. 1,481,624. *Nat. Petr. News* **16**, (8), 77.

Centrifugal Separators for Dehydrating or otherwise Purifying Oil.—De Laval Chadburn Co., Ltd., and H. Johnstone. Brit. Pat. 223,656. *Chem. Age* **11**, 559.

Apparatus for the Recovery and Refining of Light Hydrocarbon Oils and Gases from Oil Wells.—W. J. Knox and A. R. Speer.—U.S. Pat. 1,484,718. *Nat. Petr. News* **16**, (14), 125.

Fluid-operated Well-drilling Apparatus.—C. Scharpenberg. U.S. Pat. 1,482,702. *Nat. Petr. News* **16**, (14), 125.

Oil Well Agitator.—T. H. Gallagher, Assd. to Twin Packer Oil and Gas Co. U.S. Pat. 1,482,845. *Nat. Petr. News* **16**, (14), 125.

Well Cleaner.—R. E. Carmichael. U.S. Pat. 1,484,601.

Filters for Fluids, more Particularly for Liquid Hydrocarbons such as Petrol.—S. E. Pethoud. Brit. Pat. 187,241.

Vaporisers for Use on Internal-combustion Engines.—R. A. Lister and Co., Ltd., and A. F. Saunders. Brit. Pat. 270, 322.

Carburettors.—F. A. Mills. Brit. Pat. 207,220.

14. Testing, Analysis and Apparatus.

Determination of Viscosities.—*Aeronautical Research Committee Rept.* H.M. Stationery Office.

The Estimation of Methane Hydrocarbons in Technical Gas Analysis.—H. Tropsch and E. Dittrich. *Brennstoff-Chem.* **5**, 285.

Calorimetric Investigations. VII. New Constructions of Calorimetric Bombs.—P. E. Verkade and J. Coops, Jr. *Chem. Weekblad.* **21**, 282. *Chem. Abstr.* **18**, 2825.

Fractionating Apparatus.—L. P. Edel. *Chem. Weekblad.* **21**, 287. *Chem Abstr.* **18**, 2823.

The Measurement of Surface Tension, especially by the Tearing-off Method, and the Surface Tension of Water.—P. Lenard, R. v. Dallwitz-Wegener and E. Zachmann. *Ann. Physik* **74**, 381. *Chem. Abstr.* **18**, 2827.

Determination of Softening Temperatures by the Fluidity Method.—E. C. Bingham. *J. Phys. Chem.* **28**, 263. *Chem. Abstr.* **18**, 2828.

The Investigation of Benzene, Benzide and Turpentine Oil.—J. Pritzker and R. Jungkunz. *Chem. Zeit.* **48**, 455. *Chem. Abstr.* **18**, 2959.

Determination of Sludge Value (of Mineral Oils).—Bauerschäfer. *Mitt. Materialpruf.* **41**, 94. *J. Soc. Chem. Ind.* **43**, B818.

THE TESTING OF KEROSENE.—J. E. Hackford. *Oil Engineering and Finance* **5**, 574.

THE CARBON RESIDUE TEST FOR LUBRICATING OILS.—W. M. Seaber. *Ind. Chemist* **1**, 22.

AN EXPERIMENTAL STILL FOR THE DETAILED STUDY OF CRUDE PETROLEUM.—N. B. Cooke. *U.S. Bureau Mines Repts. Investigations* 2632. *Chem. Age* **11**, 386. *Oil Trade J.* **15**, (10), 108.

NEW TYPE OF VISCOSIMETER.—G. Gallo and M. Tenani. *Giorn. Chim. Ind Appl.* **6**, 280. *J. Soc. Chem. Ind.* **43**, B851. *Chem. Abstr.* **18**, 3296.

LUBRICATING OIL TESTS: HOW TO MAKE THEM: WHAT THEY MEAN.—H. L. Kauffman. *Nat. Petr. News* **16** (37), 34; (39), 73; (41) 63. *Chem. Abstr.* **18**, 3475.

APPARATUS FOR THE DETERMINATION OF THE HEAT OF EVAPORATION OF LIQUIDS OF HIGH BOILING POINTS.—J. H. Awbery and E. Griffiths. *Proc. Phys. Soc. (London)* **36**, 303. *Chem. Abstr.* **18**, 2979.

A FORMULA FOR THE CALCULATION OF THE TEMPERATURE CORRECTION IN PRACTICAL DETERMINATIONS OF THE CALORIFIC VALUE.—B. Anderson. *Tids. Kemi Bergvaesen* **4**, 53. *Chem. Abstr.* **18**, 3108.

UNIFIED METHODS OF ANALYSIS OF MINERAL OILS USED AS LUBRICANTS AND FUEL.—S. Fachini. *Atti congresso naz. chim. pura applicata* **1923**, 501. *Chem. Abstr.* **18**, 3111.

DETERMINATION OF THE PROPORTION BY VOLUME OF UNSATURATED OLEFINIC HYDROCARBONS, AROMATIC HYDROCARBONS AND SATURATED HYDROCARBONS IN PETROLEUM AND TAR FRACTIONS.—N. Danaila, A. V. Andrei and E. Melinescu. *Bule. Soc. Romana Stiin.* **26**, 3. *J. Soc. Chem. Ind.* **43**, B857.

COMBUSTION OF PETROLEUM HYDROCARBONS.—C. F. Mabery. *Ind. Eng. Chem.* **16**, 911. *J. Soc. Chem. Ind.* **43**, B857. *Chem. Abstr.* **18**, 3472.

DETERMINATION OF SETTING TIME OF PARAFFIN WAX.—K. Fricke. *Chem. Zeit.* **48**, 624. *J. Soc. Chem. Ind.* **43**, B858.

N.P.A. APPROVES CHANGES IN STANDARDS AND METHODS OF TESTING.—*Nat. Petr. News* **16**, (40), 59.

RAPID VISCOSIMETER.—H. W. Klever. *Z. angew. Chem.* **37**, 696. *J. Soc. Chem. Ind.* **43**, B892.

RELATION BETWEEN THE TIMES OF FLOW IN THE KLEVER RAPID VISCOSIMETER AND THE ENGLER VISCOSIMETER.—H. W. Klever, R. Bilfinger and K. Mauch. *Z. angew. Chem.* **37**, 693. *J. Soc. Chem. Ind.* **43**, B892

A NEW SLUDGING TEST FOR TRANSFORMER OILS.—W. H. Nuttall. *World Power* **2**, 92. *Chem. Abstr.* **18**, 3268.

DETERMINATION OF THE FRICTION OF LUBRICANTS.—R. Vieweg. *Petroleum* **20**, 899. *Chem. Abstr.* **18**, 3268.

DETERMINATION OF PARAFFIN HYDROCARBONS IN TECHNICAL GAS ANALYSIS.—H. Tropsch and E. Dittrich. *Brennstoff-Chem.* **5**, 285. *J. Soc. Chem. Ind.* **43**, B897.

Determination of Sulphur in Gas by Hydrogenation.—K. F. Tromp, *Het Gas* **44**, 227. *Chem. Zentr.* **95**, II, 1647. *J. Soc. Chem. Ind.* **43**, B897.

Application of Zelinsky's Method of Catalytic Dehydrogenation to the Detection of Decahydronaphthalenes in Low-temperature Tar.—H. Kaffer. *Ber.* **57**, 1261. *J. Soc. Chem. Ind.* **43**, B900.

Micro-combustion Bomb and Micro-calorimeter.—W. A. Roth, H. Ginsberg and R. Lassé. *Z. Elektrochem.* **30**, 417. *J. Soc. Chem. Ind.* **43**, B928.

New Method of Micro-gas Analysis.—L. Reeve. *J. Chem. Soc.* **125**, 1946. *J. Soc. Chem. Ind.* **43**, B928.

A Boiling Point Correction Chart for Normal Liquids.—W. H. Bahlke and R. E. Wilson. *Ind. and Eng. Chem.* **16**, 1131.

Determination of Dilution of Crank Case Oil.—H. H. Kroeh, P. A. Crosby and R. R. Matthews. *Ind. and Eng. Chem.* **16**, 1153.

Determination of Latent Heats of Vaporisation of Liquids at High Pressures.—W. H. McAdams and J. C. Morrell. *Ind. and Eng. Chem.* **16**, 375. *J. Soc. Chem. Ind.* **43**, B929.

The Standardisation of Combustion Calorimeters and the International Adjustment of the Standard Value.—W. A. Roth, *Naturwissenschaften* **12**, 652. *Chem. Abstr.* **18**, 3308.

Determination of Carbon, Hydrogen and Nitrogen in Organic Compounds.—J. Heslinga. *Rec. trav. chim.* **43**, 551. *J. Soc. Chem. Ind.* **43**, B970.

New Instrument Developed to Show True Body of Oils.—R. W. A. Brewer. *Auto. Ind.* **40**, 1244.

Patent.

Viscosity Testing Apparatus.—W. F. Osborne. U.S. Pat. 1,502,118. *Chem. Abstr.* **18**, 2825.

15. Cracking and Hydrogenation.

Petrol and its Derivatives. Study of Cracking. Parts I. and II.—H. Gault. *Matières grasses* **17**, 6870, 6907.

Industrial Significance of Cracking.—C. E. Bowles. *Oil and Gas J.* **23**, (9-A), 20. *Chem. Abstr.* **18**, 2958.

First Knox Cyclic Cracking Plant.—L. M. Fanning. *Oil and Gas J.* **23**, (8-A), 104.

Petroleum Cracking Processes and Future Production Problems.—T. A. Boyd. *Ind. and Eng. Chem.* **16**, 1004.

Necessity of Formulating the Fundamental Principles of the New Industry of the Transformation of Various Substances into Volatile Hydrocarbons by Cracking and Catalysis.—A. Guiselin. *Chim. et Ind.* **11** (Spec. No.), 268. *Chem. Abstr.* **18**, 3110.

CATALYTIC DECOMPOSITION OF HEXAHYDROAROMATIC AND SATURATED ALIPHATIC HYDROCARBONS. CONTRIBUTION ON THE CRACKING OF OIL. —V. Grignard and R. Stratford. *Compt. rend.* **178**, 2149. *J. Soc. Chem. Ind.* **43**, B661. *Chem. Abstr.* **18**, 3110. *Les Matières grasses* **17**, 6912.

EFFECT OF LIQUID PHASE CRACKING SHOWN.—G. H. Clay. *Oil and Gas J.* **23**, (14-A), 92. *Chem. Abstr.* **18**, 3472.

TREATMENT OF MEXICAN ASPHALT AND PARAFFIN WAX BY HEATING UNDER PRESSURE WITH SODIUM FORMATE AND WITH CARBON MONOXIDE AND WATER RESPECTIVELY.—H. I. Waterman and F. Kortlandt. *Rec. trav. chim.* **43**, 249. *J. Soc. Chem. Ind.* **43**, B898. *Chem. Abstr.* **18**, 2425.

POSSIBILITIES IN THE LOW PRESSURE CRACKING OF LOW GRADE FUEL OIL. —C. J. von Bibra. *Ref. and Nat. Gas. Mfr.* **3**, (10), 13.

FACTS AND FAKES AMONG CRACKING PROCESSES.—R. H. Brownlee. *Chem. and Met. Eng.* **31**, 737.

FERROUS SELENIDE AS A CATALYST FOR CRACKING (OILS).—T. Midgley and C. A. Hochwalt. *Ind. and Eng. Chem.* **16**, 365. *J. Soc. Chem. Ind.* **43**, B932.

PETROLEUM-CRACKING PROCESSES AND FUTURE PRODUCTION PROBLEMS.— T. A. Boyd. *Ind. and Eng. Chem.* **16**, 1007. *Chem. Abstr.* **18**, 3473.

PATENTS.

METHODS OF LOWERING THE VISCOSITY OF HYDROCARBON OIL.—H. H. Culmer. U.S. Pat. 1,505,870. *Ref. and Nat. Gas. Mfr.* **3**, (9), 36. *J. Soc. Chem. Ind.* **43**, B821. *Chem. Abstr.* **18**, 3270. *Nat. Petr. News* **16**, (42), 114.

APPARATUS FOR CRACKING AND REFINING OIL.—E. A. Reilly and R. McLain. U.S. Pat. 1,501,371. *Chem. Abstr.* **18**, 2804. *J. Soc. Chem. Ind.* **43**, B821. *Nat. Petr. News* **16**, (36), 90.

PROCESS OF MAKING METHANE.—Farbw. vorm. Meister, Lucius, u. Brüning. Brit. Pat. 215,374. *J. Soc. Chem. Ind.* **43**, B848.

CRACKING OR DECOMPOSITION OF MATERIAL CONTAINING HYDROCARBONS. —M. Melamid. Brit. Pat. 221,559. *Chem. Age* **11**, 400.

DISTILLATION WITH ALUMINIUM CHLORIDE.—A. McD. McAfee, Assr. to Gulf Refining Co. U.S. Pat. 1,501,104. *Nat. Petr. News* **16**, (36), 90. *Ref and Nat. Gas. Mfr.* **3**, (8), 39.

TREATMENT OF LIQUID HYDROCARBONS.—S. J. M. Auld, A. E. Dunstan, and P. H. Herring. Brit. Pat. 220,664. *J. Soc. Chem. Ind.* **43**, B899. *Chem. Age* **11**, 329.

CRACKING OF HYDROCARBON OILS AND TREATMENT OF SOLID CARBONACEOUS SUBSTANCES.—T. M. Davidson and G. P. Lewis. Brit. Pat. 220,732. *J. Soc. Chem. Ind.* **43**, B899. *Chem. Age* **11**, 330.

PROCESS OF CRACKING HYDROCARBON OILS.—J. H. Adams, Assr. to The Texas Co. U.S. Pat. 1,506,877. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39. *Chem. Abstr.* **18**, 3475.

PROCESS OF REFINING OIL.—D. Pyzel. U.S. Pat. 1,506,444. *J. Soc. Chem. Ind.* **43**, B899. *Chem. Abstr.* **18**, 3270. *Nat. Petr. News* **16**, (42), 112. *Ref. and Nat. Gas. Mfr.* **3**, (9), 36.

APPARATUS FOR THE CONVERSION AND TRANSFORMATION OF LIQUIDS, FLUIDS AND OILS.—J. H. Adams, Assr. to The Texas Co. U.S. Pat. 1,506,878. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39.

APPARATUS FOR DISTILLING MINERAL OIL.—E. Billow and A. M. Allen. U.S. Pat. 1,507,659. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39.

APPARATUS FOR CONVERTING OIL.—R. T. Pollock, Assr. to Universal Oil Products Co. U.S. Pat. 1,509,819. *Ref. and Nat. Gas. Mfr.* **3**, (10), 40.

DISTILLING OIL WITH ALUMINIUM CHLORIDE.—A. McD. McAfee, Assgd. to Gulf Refining Co. U.S. Pat. 1,478,444. *Nat. Petr. News* **16**, (4), 77.

PROCESS OF AND APPARATUS FOR THE MANUFACTURE OF LOWER-BOILING HYDROCARBONS.—A. McD. McAfee, Assgd. to Gulf Refining Co. U.S. Pat. 1,476,091. *Nat. Petr. News* **16**, (4), 77.

PROCESS OF MIXING AND DELIVERING OIL AND ALUMINIUM CHLORIDE.—G. H. King, Assgd. to Gulf Refining Co. U.S. Pat. 1,478,438. *Nat. Petr. News* **16**, (4), 77.

COOLING STILL.—T. L. Watkeys, Assgd. to Gulf Refining Co. U.S. Pat. 1,478,438. *Nat. Petr. News* **16**, (4), 77.

PROCESS OF DISTILLING WITH CATALYTIC CHEMICALS.—G. L. Prichard and H. Henderson, Assgd. to Gulf Refining Co. U.S. Pat. 1,476,219. *Nat. Petr. News* **16**, (4), 77.

APPARATUS FOR AND METHOD OF CRACKING HYDROCARBONS.—F. E. Wellman, Assgd. to The Kansas City Gasoline Co. U.S. Pat. 1,478,413. *Nat. Petr. News* **16**, (4), 77.

GASOLINE RECOVERY.—W. Brink. U.S. Pat. 1,477,103. *Nat. Petr. News* **16**, (4), 77.

ART OF TREATING OILS.—E. M. Clark, L. E. Loomis and J. R. Carringer, Assgd. to Standard Development Co. U.S. Pat. 1,478,413. *Nat. Petr. News* **16**, (4), 77.

OIL-CONVERTING APPARATUS FOR THE CONVERSION AND TRANSFORMATION OF OILS.—J. H. Adams, Assgd. to The Texas Co. U.S. Pat. 1,477,860. *Nat. Petr. News* **16**, (4), 79.

PETROLEUM REFINING APPARATUS.—C. B. Watson. U.S. Pat. 1,474,395. *Nat. Petr. News* **16**, (4), 79.

PROCESS OF TREATING HYDROCARBONS.—G. Egloff. U.S. Pat. 1,478,559. *Nat. Petr. News* **16**, (4), 79.

METHOD OF CRACKING OILS.—J. G. Davidson, Assgd. to C. H. Conner. U.S. Pat. 1,479,653. *Nat. Petr. News* **16**, (8), 77.

METHOD FOR REFINING OILS.—W. J. Reilly. U.S. Pat. 1,479,833. *Nat. Petr. News* **16**, (8), 77.

PROCESS OF CONVERTING OILS.—A. McD. McAfee, Assgd. to Gulf Refining Co. U.S. Pat. 1,482,438. *Nat. Petr. News* **16**, (14), 125.

PROCESS FOR CONVERSION OF HYDROCARBON OILS AND SIMILAR SUBSTANCE. —V. L. Emerson. U.S. Pat. 1,484,014. *Nat. Petr. News* **16**, (14), 125

METHOD OF TREATING HYDROCARBONS.—C. P. Dubbs, Assgd. to Universal Oil Products Co. U.S. Pat. 1,484,445. *Nat. Petr. News* **16**, (14), 125.

CONTINUOUS METHOD OF CRACKING HYDROCARBON OILS.—E. O. Linton, Assgd. to Linton Gasoline Process Co. U.S. Pat. 1,484,513. *Nat. Petr. News* **16**, (14), 125.

PROCESS FOR TREATING HYDROCARBONS.—S. L. Gartlan and A. E. Gooderham. U.S. Pat. 1,484,612. *Nat. Petr. News* **16**, (14), 125.

APPARATUS FOR CONVERTING HEAVY HYDROCARBONS INTO LIGHTER HYDROCARBONS.—W. F. Muehl, Assgd. to Interstate Refineries Inc. U.S. Pat. 1,484,958. *Nat. Petr. News* **16**, (14), 125.

APPARATUS FOR CRACKING HYDROCARBONS AND RECOVERING GASOLINE.— M. H. Kotzebue and L. M. Bowman. U.S. Pat. 1,485,083. *Nat. Petr. News* **16**, (14), 125.

PROCESSES AND APPARATUS FOR CRACKING OILS.—J. F. Monnot. Brit. Pat. 208,310.

16. INSULATING OILS.

CATALYTIC ACTION OF METALS ON MINERAL OILS.—H. Stäger and J. P. Bohnenblust. *Bull. schweiz. elektrotechn. Ver.* **1924**, (3). *Chem. Zentr.* **95**, II., 1420. *J. Soc. Chem. Ind.* **43**, B898.

HALOGENATED HYDROCARBONS AS DIELECTRICS: EFFECT ON FLASH AND FIRE POINT OF TRANSFORMER OILS.—H. C. P. Weber and R. H. Wynne. *Trans. Amer. Electrochem. Soc.* **46**, 189. *J. Soc. Chem. Ind.* **43**, B915. *Chem. Abstr.* **18**, 3324.

TRANSFORMER OILS.—H von der Heyden and K. Typke. *Z. angew. Chem.* **37**, 853. *Elektrotechn.-Zeit.* **45**, 931. *Chem. Abstr.* **18**, 3474. *Petroleum* **20**, 1323.

HEATING TRANSFORMER OILS WITH METALS IN PRESENCE OF EXCESS AIR. —H. von der Heyden and K. Typke. *Petroleum* **20**, 1128. *Chem. Abstr.* **18**, 3474. *J. Soc. Chem. Ind.* **43**, B739.

EFFECT OF VARIOUS SOAPS ON TRANSFORMER OIL.—H. von der Heyden and K. Typke. *Petroleum* **20**, 857. *Chem. Abstr.* **18**, 3474. *J. Soc. Chem. Ind.* **43**, 624.

17. SHALE AND SHALE OILS.

GASOLINE FROM SHALE.—V. C. Alderson. *Colo. Sch. Mines Quar. Petr. Ags* **14**, (8), 60.

THE WORLD'S OIL-SHALE DEPOSITS.—G. W. Wallace. *Eng. and Min. J. Press. Chem. Trade J.* **75**, 394.

Oil Shale throughout the World.—V. C. Alderson. *Combustion* **11**, 56. *Chem. Abstr.* **18**, 2959.

Isolation of the Organic Matter Present in Kaustobiolites.—F. C. Gaisser. *Brennstoff-Chem.* **5**, 253. *J. Soc. Chem. Ind.* **43**, B816.

Coal from an Oil Shale.—F. C. Gaisser. *Brennstoff-Chem.* **5**, 254. *J. Soc. Chem. Ind.* **43**, B817.

The Oil-shale and Oil-shale Industry in Esthonia.—L. S. Polak. *Oil Engineering and Finance* **5**, 561, 618.

Status of the Shale Oil Industry.—G. W. Wallace. *Eng. and Min. J.-Press* **118**, 290.

What about Oil Shale?—S. D. Kirkpatrick. *Chem. and Met. Eng.* **31**, 611, 688. *Petr. Times* **12**, 787.

Economic Problems in Oil-shale Development.—S. D. Kirkpatrick. *Chem. and Met. Eng.* **31**, 651.

Principles of Oil Shale Retorting.—J. E. Meyer. *Oil and Gas J.* **23**, (21-A), 92.

Californian Patents New Shale Distillation Process.—R. W. Jenkins. *Oil Trade J.* **15**, (10), 26.

New Shale Distillation Process Uses Natural Principles.—C. O. Sprenger. *Oil Trade J.* **15**, (10), 44.

The Trumble Oil Shale Cycle Distillation Plant.—V. C. Alderson. *Railroad Red Book* **41**, 789. *Petr. Times* **12**, 327. *Chem. Abstr.* **18**, 3474.

The Bituminous Minerals of the Province of Santander.—J. M. De Mazarrasa and J. Luna. *Boll. oficial minas metalurgia* **1923**, (7), 1. *Fuel in Science and Practice* **3**, 264. *Chem. Abstr.* **18**, 2475.

American Progress in Retorting Oil Shale.—S. D. Kirkpatrick. *Chem. and Met. Eng.* **31**, 770.

Describes new Swedish Oil Shale Progress.—U S. Commerce Rept. *Nat. Petr. News* **16**, (9), 89.

Patents.

Destructive Distillation Apparatus.—F. Lamplough. Brit. Pat. 221,009. *Chem. Age* **11**, 351.

Processes of Treating Carbonaceous Materials.—M. J. Trumble. Brit. Pat. 221,052. *Chem. Age* **11**, 351.

Apparatus for Discharging Granular Materials, etc., from Retorts and Similar Vessels.—T. W. S. Hutchins. U.S. Pat. 1,503,791. *Chem. Abstr.* **18**, 2826.

Retort for Distilling Oil from Shale.—P. L. Bennett. U.S. Pat. 1,501,881. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39. *Chem. Abstr.* **18**, 2960. *J. Soc. Chem. Ind.* **43**, B821. *Nat. Petr. News* **16**, (36), 92.

SHALE RETORT.—D. H. Francis. U.S. Pat. 1,503,234. *Nat. Petr. News* **16**, (36), 92. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39. *J. Soc. Chem. Ind.* **43**, B779.

SHALE DISTILLATION APPARATUS.—R. M. Catlin, Assr. to Catlin Shale Products Co. U.S. Pat. 1,503,093. *Nat. Petr. News* **16**, (36), 92. *Ref. and Nat. Gas. Mfr.* **3**, (8), 39. *J. Soc. Chem. Ind.* **43**, B779.

PROCESSES OF CARBONISING.—S. G. S. Dicker. From S. E. Co. Brit. Pat. 221,388. *J. Soc. Chem. Ind.* **43**, B898. *Chem. Age* **11**, 379.

METHOD OF PRODUCING A HYDRAULIC CEMENT AND ARTIFICIAL STONES FROM BITUMINOUS SHALE-SLAG.—O. Schmidt and M. Hahnle. Brit. Pat. 221,017. *J. Soc. Chem. Ind.* **43**, B911.

PROCESS OF DISTILLING CARBONACEOUS MATERIAL.—R. M. Catlin, Assr. to Catlin Shale Products Co. U.S. Pat. 1,509,667. *Ref. and Nat. Gas. Mfr.* **3**, (10), 39. *J. Soc. Chem. Ind.* **43**, B933.

SHALE RETORT.—C. J. Dunten. U.S. Pat. 1,482,677. *Nat. Petr. News* **16**, (14), 126.

APPARATUS FOR TREATING HYDROCARBON-CONTAINING MATERIALS.—C. P. Bowie and M. J. Gavin. U.S. Pat. 1,480,045. *Nat. Petr. News* **16**, (8), 77.

RETORT APPARATUS FOR THE TREATMENT OF MATERIALS SUCH AS SHALE, COAL AND THE LIKE.—W. Guy-Pell. Brit. Pat. 223,652. *Chem. Age* **11**, 559.

APPARATUS FOR EXTRACTING OIL FROM SHALE OR THE LIKE.—S. E. Company. Brit. Pat. 204,335.

18. LIGNITES AND COALS AND THEIR PRODUCTS.

THE FUTURE OF ARTIFICIAL LIQUID FUELS IN FRANCE.—M. de Coninck. *Chaleur et Ind.* **5**, 269. *Chem. Abstr.* **18**, 2952.

THE CHEMICAL BEHAVIOUR OF RHENISH BROWN COALS.—H. Tropsch. *Brennstoff-Chem.* **5**, 129. *Chem. Abstr.* **18**, 2953.

PREPARATION OF CERESIN HYDROCARBONS FROM MONTAN WAX.—J. Marcusson. *Z. angew. Chem.* **37**, 413. *Chem. Abstr.* **18**, 2957.

THE INFLUENCE OF STRUCTURE IN THE PREPARATION OF SMOKELESS FREE-BURNING FUELS.—D. Brownlie. *Ind. Chemist* **1**, 34.

KOHLENCHEMIE. ENTSTEHUNG UND CHEMISCHES VERHALTEN DER KOHLEN UND IHRER BESTANDTEILE, UNTERSUCHUNG DER KOHLEN.—H. Strache and R. Lant. Akademische Verlags-Gesellschaft, m.b.H. Leipzig. *Ind. and Eng. Chem.* **16**, 1094.

COAL CARBONISATION.—H. C. Porter. The Chemical Catalog Co. Inc., New York.

DISTILLATION OF LIGNITES.—L. de Pritzbuer. *Chim. et Ind.* **11**, (Special No.), 258. *Chem. Abstr.* **18**, 3107.

PRACTICAL COAL CARBONISATION.—F. W. Sperr. *Mech. Eng.* **46**, 329. *Chem. Age (New York)* **32**, 277. *Chem. Abstr.* **18**, 3108.

DISTILLATION AND GASIFICATION OF LIGNITE.—C. Arnemann. *Z. für angew. Chem.* **37**, 713. *Chem. and Met. Eng.* **31**, 633.

INVESTIGATION OF CRUDE TAR AND ITS PRODUCTS.—E. Koch. *Chem. Zeit.* **43**, 581. *Chem. and Met. Eng.* **31**, 633.

THE LOW-TEMPERATURE CARBONISATION OF COAL.—Fuel Research Board Rept. *Petr. Times* **12**, 691.

INFLUENCE OF THE CONSTRUCTION OF REVOLVING RETORTS ON THE COMPOSITION OF LOW-TEMPERATURE TAR AND MOTOR SPIRIT.—F. G. Hoffmann. *Brennstoff-Chem.* **5**, 287. *J. Soc. Chem. Ind.*, B897.

LOW-TEMPERATURE DISTILLATION.—H. Nielsen. Smoke Abatement League Conference. *Chem. Trade J.*, **75**, 549.

REPORT OF TEST BY THE DIRECTOR OF FUEL RESEARCH ON PARKER LOW-TEMPERATURE CARBONISATION PLANT INSTALLED AT BARUGH, BARNSLEY, AT THE WORKS OF LOW-TEMPERATURE CARBONISATION, LTD.—H.M. Stationery Office, London. *Oil Engineering and Finance* **5**, 633. *Oil News* **16**, 468. *Chem. Trade J.* **75**, 491.

CARBONISATION DES BOIS LIGNITES ET TOURBES.—C. Mariller. Dunod, Paris.

LIGNITE, A FUTURE FUEL?—O. P. Hood. *Ind. and Eng. Chem.* **16**, 1023. *Chem. Abstr.* **18**, 3465.

LOW-TEMPERATURE CARBONISATION.—C. H. Lander. *Colliery Guardian* **128**, 155. *Chem. Abstr.* **18**, 3468.

PRIMARY TAR, ITS INVESTIGATION AND ITS PRODUCTS.—E. Koch. *Chem. Zeit.* **43**, 581. *Chem. Abstr.* **18**, 3469.

THE CONVERSION OF COAL INTO OILS.—F. Fischer. *Colliery Guardian* **128**, 87. *Chem. Abstr.* **18**, 2470. *Ind. Chemist* **1**, 51.

THE MACLAURIN PROCESS OF PRODUCING SMOKELESS FUEL.—R. Sturrock. *Gas World. Gas J.* **165**, 206. *Chem. Abstr.* **18**, 3470.

PATENTS.

RETORT FURNACES.—J. Pieters. Brit. Pat. 219,692. *Chem. Age* **11**, 352.

HYDROCARBONS FROM COAL, PEAT AND OTHER MATERIALS.—G. Linnmann. Brit. Pat. 214,940. *Chem. Abstr.* **18**, 2955. *J. Soc. Chem. Ind.* **43**, B778.

DEHYDRATED LIGNITE.—E. P. Schoch. U.S. Pat. 1,508,617. *J. Soc. Chem. Ind.* **43**, B898.

FUEL DISTILLATION.—Electrical Improvements, Ltd., and E. G. Weeks. Brit. Pat. 223,297. *Chem. Age* **11**, 529.

LOW-TEMPERATURE DISTILLATION.—Metz and McLellan and E. G. Weeks. Brit. Pat. 223,387. *Chem. Age* **11**, 529.

INTERMITTENT SYSTEM FOR TREATMENT OF COAL.—J. F. Fenton. U.S. Pat. 1,484,256. *Nat. Petr. News* **16**, (14), 126.

RETORTS FOR THE CARBONISATION OF SOLID FUELS.—A. L. J. Queneau. Brit Pat. 221,679. *Chem. Age* **11**, 401.

10. PITCH, ASPHALT AND BITUMEN.

ASPHALT INDUSTRY ACTIVE IN 1923.—U.S. Dept. of the Interior. *Chem. and Met. Eng.* **31**, 464.

ASPHALT AND LEAD IN ANCIENT INDUSTRY.—P. Diergart. *Chem. App.* **11**, 97.

INVESTIGATION OF ERMELO TORBANITE.—H. Williams. *J. S. Afr. Chem. Inst.* **7**, 26. *J. Soc. Chem. Ind.* **43**, B857.

U.S. GOVERNMENT MASTER SPECIFICATION FOR ASPHALT FOR WATERPROOFING AND DAMP-PROOFING.—*U.S. Bureau Standards Circ.* 160. *J. Soc. Chem. Ind.* **43**, B858.

ASPHALT AND RELATED BITUMENS PRODUCED IN THE UNITED STATES IN 1923.—U.S. Geol. Surv. *Petr. World* **21**, 470.

ECONOMIC FACTORS IN ROOFING MANUFACTURE.—J. L. McK. Yardley. *Chem. and Met. Eng.* **31**, 659.

U.S. GOVERNMENT MASTER SPECIFICATION FOR ASPHALT FOR UNSURFACED BUILT-UP ROOFING.—*U.S. Bur. Standards Circ.* 168.

THE FUELS OF SICILY.—M. Neora. *Rass. min. met. chim.* **61**, 14. *Chem. Abstr.* **38**, 3464.

BITUMINOUS OILS OBTAINED FROM THE DISTILLATION OF ABRUZZO BITUMENS.—G. Cossettini. *Giorn. chim. ind. applicata* **6**, 277. *Chem. Abstr.* **18**, 3474.

NEW PROCESS FOR EXTRACTING BITUMEN FROM ASPHALTIC AND BITUMINOUS ROCKS BY MEANS OF AQUEOUS ACID SOLUTIONS.—G. Cossettini. *Giorn. chim. ind. applicata* **6**, 276. *Chem. Abstr.* **18**, 3475.

ASPHALT.—P. Hubbard. *Mineral Ind.* **32**, 70. *Chem. abstr.* **18**, 3475.

POINTS TO CONSIDER IN THE SUCCESSFUL APPLICATION OF ROAD OIL.—F. W. Padgett. *Nat. Petr. News* **16**, (12), 87.

EXTENT AND CHARACTERISTICS OF NORTHERN ALBERTA BITUMINOUS SANDS. S. E Ells. *Nat. Petr. News* **16**, (15), 69, (17), 75.

PATENTS.

PLASTIC COMPOSITION.—H. Knight. U.S. Pat. 1,505,206. *J. Soc. Chem. Ind.* **43**, B831.

PAVEMENT COMPOSITION.—A. M. Fairlie, Assr. to Tennessee Copper and Chemical Corp. U.S. Pat. 1,505,880. *J. Soc. Chem. Ind.* **43**, B831. *Chem. Abstr.* **18**, 3265.

BITUMINOUS COMPOSITION.—L. Kirschbraun. U.S. Pat. 1,506,371. *Chem. and Met. Eng.* **31**, 551.

ELASTIC AND EXPANSIBLE PAVING JOINT.—A. C. Fischer. U.S. Pat. 1,503,942. *Chem. Abstr.* **18**, 3265.

WATERPROOFING CONCRETE WALLS AND OTHER MATERIALS.—J. von Vass. U.S. Pat. 1,505,112. *Chem. Abstr.* **18**, 3265.

PREPARATION OF MIXTURES OF TAR AND BITUMEN, OR THE LIKE.—F. H. Butler and F. J. Popham. Brit. Pat. 221,234. *J. Soc. Chem. Ind.* **43**, B900. *Chem. Trade J.* **75**, 557.

BITUMINOUS COMPOSITIONS.—F. E. Atherton. Brit. Pat. 220,393. *J. Soc. Chem. Ind.* **43**, B900.

MANUFACTURE OF EMULSIONS OR SOLUTIONS OF TAR OR THE LIKE.—L. W. Low. Brit. Pat. 221,380. *J. Soc. Chem. Ind.* **43**, B900.

ASPHALT.—H. Goodwin. Can. Pats. 242,208-9. *Chem. Abstr.* **18**, 3476.

PROCESS FOR PRODUCING SOLUBLE TAR, BITUMINOUS ASPHALTIC OR OLEAGINOUS COMPOUND FOR USE ON ROADS, PATHS AND SUCH LIKE.—T. Murphy. Brit. Pat. 206,888.

20. PARAFFIN, OZOKERITE, VASELINE.

CERESINS.—S. Lawson. *Oil Engineering and Finance* **5**, 522. *Chem. Abstr.* **18**, 3474.

22. PHYSICAL PROPERTIES OF PETROLEUM AND ITS PRODUCTS.

VISCOSITY-TEMPERATURE CURVES OF FRACTIONS OF TYPICAL AMERICAN CRUDE OILS. II.—F. W Lane and E. W. Dean. *Ind. and Eng. Chem.* **16**, 905. *J. Soc. Chem. Ind.* **43**, B858. *Chem. Abstr.* **18**, 3472.

FLOW OF FLUIDS IN PIPE BENDS.—J. Eustice. *Water and Water Eng.* **26**, 270. *Chem. Abstr.* **18**, 3238.

MECHANISM OF LUBRICATION.—D. P. Barnard, H. M. Myers and H. O. Forrest. *Ind. and Eng. Chem.* **16**, 347. *J. Soc. Chem. Ind.* **43**, B932.

VISCOSITY AND FREE SPACE.—W. Herz. *Z. anorg. allgem. Chem.* **136**, 325. *Chem. Abstr.* **18**, 3300.

VISCOSITY AND SURFACE TENSION OF (LUBRICATING) OILS.—J. Don. *Kolloid-Zeit* **34**, 312. *J. Soc. Chem. Ind.* **43**, B818.

23. CHEMISTRY OF PETROLEUM.

THE NATURE OF THE ADSORPTION OF LARGE-SURFACE MATERIALS.—E Berl and E. Wachendorff. *Z. angew. Chem.* **37**, 747.

SOLID PARAFFIN IN PETROLEUM.—M. A. Rakusin. *Petroleum* **20**, 951. *Chem. Abstr* **18**, 2956.

AROMATIC HYDROCARBONS IN BURMAH PETROLEUM.—H. M. Mulany and E. R. Watson. *Chem. and Ind.* **43**, 310T. *Petr. Times* **12**, 711.

CHLORINATION OF THE NATURAL GAS OF VAUX (FRANCE).—H. Gault and H. Benlian. *Chim. et Ind.* **11**, (Special No.), 272. *Chem. Abstr.* **18**, 3109.

SOLUBILITY OF THE PETROLEUM HYDROCARBONS.—C. F. Mabery. *Ind. and Eng. Chem.* **16**, 937. *Chem. Abstr.* **18**, 3110. *J. Soc. Chem. Ind.* **43**, B857.

SUGGESTED MECHANISM FOR ANTI-KNOCK ACTION (OF LEAD TETRAETHYL IN INTERNAL-COMBUSTION ENGINES).—G. L. Wendt and F. V. Grimm. *Ind and Eng. Chem.* **16**, 890. *J. Soc. Chem. Ind.* **43**, B856. *Chem. Abstr.* **18**, 3266.

RELATIVE EFFECTS OF SOME NITROGEN COMPOUNDS UPON DETONATION IN ENGINES.—T. A. Boyd. *Ind. and Eng. Chem.* **16**, 893. *J. Soc. Chem. Ind.* **43**, B857.

ELEMENTS OCCURRING IN PETROLEUM OTHER THAN CARBON AND HYDROGEN. —J. E. Hackford. *Oil Engineering and Finance* **5**, 344. *Oil and Gas J.* **23**, (16-A), 108.

THE CHEMISTRY OF "SWEETENING" IN THE PETROLEUM INDUSTRY.—G. L. Wendt and S. H. Diggs. *Ind. and Eng. Chem.* **16**, 1113.

ACTION OF PETROLEUM REFINING AGENTS ON PURE ORGANIC SULPHUR COMPOUNDS DISSOLVED IN NAPHTHA.—A. E. Wood, A. Lowy and W. F. Faragher. *Ind. and Eng. Chem.* **16**, 1116.

NEW CONTRIBUTION TO THE OXIDATION OF PETROLEUM.—C. Cândea. *Mon. pétrole Roumain* **23**, 1295. *Chem. Abstr.* **18**, 3472.

ADSORPTION OF RESINS AND PARAFFINS.—L. Gurvich. *Petroleum* **20**, 903. *Chem. Abstr.* **18**, 3474.

PATENTS.

PREPARATION OF BROMO DERIVATIVES OF METHANE.—Elektrochem. Werke G.m.b.H. H. Bosshard, K. Steinitz and D. Strauss. Ger. Pat. 391,745. *J. Soc. Chem. Ind.* **43**, B811.

PROCESS OF TREATING PETROLEUM STILL GASES (TO PREPARE CHLOROHYDRINS).—B. T. Brooks, Assr. to Chadeloid Chemical Co. U.S. Pat. 1,498,781–2. *Chem. and Met. Eng.* **31**, 198. *Chem. Abstr.* **18**, 2600. *J. Soc. Chem. Ind.* **43**, B808.

PREPARATION OF ALCOHOLS AND ALDEHYDES FROM HYDROCARBONS.—C. A. Kloppenburg, Assr. to Naaml. Vennoots. de Bataafsche Petr. Maatschappij. U.S. Pat. 1,500,080. *J. Soc. Chem. Ind.* **43**, B808.

PURIFYING ISOPROPYL ALCOHOL.—M. D. Mann, Jr. U.S. Pat. 1,502,149. *Chem. Abstr.* **18**, 2901.

CHLORINATION OF METHANE.—Holzverkohlungs. Ind. A.-G. Ger. Pat. 393,550. *J. Soc. Chem. Ind.* **43**, B848.

OXIDISING HYDROGEN SULPHIDE.—H. Carstens, A. Engelhardt and W. J. Müller, Assgd. to Farbenfabriken vorm. Friedr. Bayer and Co. U.S. Pat. 1,507,105. *Chem. and Met. Eng.* **31**, 631.

24. Oil and Petrol Gas.

Patents.

Manufacture of Carburetted Water Gas.—Humphreys and Glasgow, Ltd. From O. B. Evans, J. A. Perry and L. B. Eichengreen. Brit. Pat. 221,622. *Chem. Age* **11**, 401.

Process of and Apparatus for Making Gas.—W. C. Dayton, Assr. to General Oil Gas Corp. U.S. Pat. 1,506,164. *J. Soc. Chem. Ind.* **43**, B822. *Chem. Abstr.* **18**, 3267.

25. Miscellaneous.

National Standard Petroleum Oil Tables.—*U.S. Bureau Standards Circ.* 154.

Synthesis of Petroleum.—H. Handler. *Allgem. oesterr. Chem. Tech. Zeit.* **42**, 89. *Chem. Abstr.* **18**, 2955.

Progress and Changes in the Petroleum Industry.—W. Franckenstein. *Z. angew. Chem.* **37**, 357. *Chem. Abstr.* **18**, 2956.

The Black Golconda.—I. F. Marcosson. Harper and Bros., New York and London.

Contributions générales à l'Etude du Pétrole.—H. Tillmann. Cartea du Aur, Strada Smardan 4, Bucharest.

Appraisal of Oil and Gas Properties.—R. H. Johnson and P. Ruedemann. *Nat. Petr. News* **16**, (32), 55; (33), 67; (34), 69; (35), 63; (36), 73; (37), 75; (38), 83; (39), 80; (42), 89; (43), 63; (44), 67; (45), 81.

Cases on Oil and Gas.—V. H. Kulp. West Publishing Co.

Tax Valuation on Oil in West Virginia compared with other Property.—J. P. Flynn. *Nat. Petr. News* **16**, (40), 68.

Oil Finding Machines and Appliances.—J. B. Rathbun. *Petr. World* **21**, 464.

Less Speed, More Recovery Industry's Need.—G. O. Smith. *Oil Weekly* **35**, (3), 28.

First Principles of the Oil Business.—V. H. McNutt and C. Lambert. Gulf Publishing Co. McKinley Publishing Co., Kansas.

Galey writes on the Problems of the Landowner and Operator.—*Oil and Gas J.* **23**, (18-A), 141.

Early History of Petroleum Refining.—C. O. Willson, *Oil and Gas J.* **23**, (19-A), 100.

Sanitation in Industries Handling or Using Benzine.—P. Pouillot. *Chim. et Ind.* **11**, (Special No.), 777 *Chem. Abstr.* **18**, 3238.

Community Leases offer Advantages to Operating Companies.—J. L. Church. *Union Oil Co.'s Bull. Nat. Petr. News* **16**, (41), 55.

URGE CO-OPERATION IN OIL PRODUCTION.—C. E. Kern. *Oil and Gas J.* **23**, (23-A), 56.

DEPLETION CLAUSE AND COMMON SENSE.—W A. W. Krebs. *Oil and Gas J.* **23**, (24-A), 24.

FORM PETROLEUM RESEARCH COMMITTEE.—L. M. Fanning. *Oil and Gas J.* **23**, (24-A), 34.

SMOOTHLY WORKING MACHINE IS NEEDED IN HANDLING OIL AND GAS LEASES.—J. E. Pew. *Am. Inst. Min. and Met. Engrs. Nat. Petr. News* **16**, (17), 69.

CONTROL OF THE PETROLEUM INDUSTRY.—G. O. Smith. *Petr. World* **21**, 490.

Note.—Owing to the necessity to economise space, this bibliography will not henceforth include unsigned articles or paragraphs.

Abstracts.

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General.

Quemado Petroleum (Argentine). E. Longobardi. *Anales asoc. quim.* Argentina, 1924, **11**, 365-368.

The crude oil is black in colour and has an odour like gasoline. The physical constants are: density at 15° 0·960; flash point 41°; viscosity at 50° (Engler) 350·6; and calorific value (by the Mahler bomb) 10,719. Analysis showed a water content of 4·90 per cent. and sulphur content of 0·53 per cent. The distillation test gave: gasoline boiling below 175°, 3·40, kerosene below 300°, 12·00, lubricating oils below 360°, 17·00, and residue (asphalt) 62·7 per cent. The initial boiling point was 75°.

S. F. B.

Petroleum in Japan. A. T. Coumbe. *Petr. Times*, October 25, 1924.

Petroleum deposits have been worked in Japan for several hundred years. The first well drilled by cable-tool was brought in at Amaze (west coast of Honshu) in 1892, the yield being 69,000 barrels. Production increased steadily after this, and in 1914, when the rotary system was introduced, deeper sands were reached and production increased until a peak of 2,963,000 barrels was reached. Production has since declined for a variety of reasons.

The major portion of the production is obtained from petroliferous areas (1) along the along the West Coast of Honshu, (2) in the Niigata district of Echigo Province, (3) in the Akita district of Ugo Province. The balance of production comes from the Nagoono district of Shinano Province, the Shimoka district of Yotomi Province, Zego Island and Formosa.

The *Niigata* district produces from the Upper Tertiary, and contains four main fields:—Niitsu, Nishiyama, Higashiyama and Kubiki.

The oil from the *Niitsu* area is of mixed base type, brown in colour, and has a specific gravity of 0.933. The refined products include solar, lubricating and fuel oils, together with a small amount of kerosene.

Nishiyama crude oil is a paraffin base oil, specific gravity ·845, and yields a high percentage of light products.

Higashiyama oil has a specific gravity of from 0·840 to ·875 and is similar to the crude from Nishiyama.

The *Kubiki* field produces a reddish brown oil of 0·823 specific gravity.

The oil-bearing strata of the Akita field are of Pliocene and Miocene age. Wells are frequently brought in as gushers, but production falls off rapidly owing to decreased gas pressure. The crude is asphaltic in

character, dark brown in colour and averages ·917 specific gravity. The remaining fields are of lesser importance, none of them producing more than 20,000 barrels per year.

Japan's domestic supply of oil depends rather on the extension of modern drilling practice in existing fields than on the search for larger and more productive areas. W. H. T.

GROSNY FOUNTAIN, NEW LOCATION. *Russ. Oil Bull.*, p. 16, August 15, 1924.

Two fountains in the New Grosny district opened up a wide perspective for the future of Grosny. In 1923 steps were taken so that a five years' drilling programme could be fully assured in 1924. For this purpose several wells were drilled to the XI and XII horizons, and the latest fountains are the result of this work.

Well No. 3/33 was begun on October 30, 1923, with the rotary system, and drilling proceeded normally. At 275-284 sag. an attempt to shut off water above the XI oil-bearing horizon was not successful. Water was finally shut off above the XII horizon at 309 sag. 4 ft. 1 in. with sludge, this also being forced up behind the casings thus isolating all the upper strata from each other. The XIII horizon entered upon at 318 sag. 4 in. and drilled to 325 sag. 1 ft. consisted of marl and clay. The 6 in. casing was then taken to 327 sag. 6 ft. and a fountain struck on June 24. With a partially closed valve, with a pressure of 12 lb., the daily yield is 17,000 poods of crude petroleum and approximately 780,000 cu. ft. of gas S.G.O·9.

A comparison of No. 3/33 with other fountains of this horizon show certain differences, those on the upper plots giving a smaller pressure, less gas, but a several times greater quantity of oil, which is explained by the character of the horizons in various parts of the district.

The fact of Well No. 3/33 giving less oil than other fountains on this horizon leads to the conclusion of a higher productivity on the whole Adwisky field.

If Well No. 3/33 shows a good outlook Well No. 1/33 still further widens the possibilities of the Grosny petroleum. This latter well was in exploitation from August, 1919, to September, 1920, on horizons Nos. I and II, accompanied with a large volume of water at a high pressure, and as it was feared that this would flood out the neighbouring wells, it was decided to deepen it by the rotary system. Water was shut off at 263 sag., and only the upper part of No. XI horizon was drilled into from 268-272 sag.

Trial baling for twenty-two days, April-May, gave 35,000 poods of oil without a sign of water and an occasional fountain. This was considered unsatisfactory, and it was decided to deepen it to the XIII horizon. On June 30, with 6 in. casing at 299 sag. 2 ft. a fountain of paraffin oil was struck giving a daily output of 121,000 poods, with a partially closed valve, at a pressure of 30 lb. with 1,170,000 cu. ft. of gas S.G.I·0. It is believed that Well No. 1/33 has not reached the XIII horizon, as comparison of well sections shows that Well No. 1/33 gives, for each pood of oil, 9·65 cu. ft. of gas; Well No. 3/33 to 1 pood of oil, 43·3 cu. ft. of gas. Comparing these with Well No. 2/49, which also exploits the XIII horizon, and gives for each pood of oil approximately 20 cu. ft. gas, and Well No. 3/56, exploiting XI horizon, giving 1 pood of oil to 8-10 cu. ft. gas, it will be seen that the amount of gas in No. 3/56 is equal to that in No. 1/33, and it is possible to conclude that Well No. 1/33 has not reached XIII horizon but is producing from XI and XII, while in Well No. 3/33, located lower down the dip, there is for each pood of oil 4½ times more gas than in XI and XII horizons.

Thanks to these new wells the production on the new area has increased 100 per cent.—from 124,000 to 245,000 poods daily, and for the whole Grosny district by 30 per cent.

The last two fountains show that many more may be expected in the New Grosny area, the more so as these are not located in the best parts of the field. T. W.

PIPELINES FROM BAKU AND GROSNY. Engineer A. Tseitlin. *Russ. Oil-Bull.*, p. 4, September 1, 1924.

Emphasizing the necessity of opening up an outlet to the Black Sea for the products of oil, especially for Baku a life necessity, and without which the Baku petroleum industry will die out, the author arrives at the possibility of constructing, at one and the same time, two pipes lines—Baky Batoum and Grosny Novorossisk (Tuapse). The cost of both these pipelines will be slightly higher than the variations which have been examined up to the present—viz., the second 8 in. Baku Batoum line and the 8 in. Grosny Black Sea line. The proposal consists of relaying the existing 8 in. pipeline, Baku Batoum, with 12 in. line pipe and not to lay a second 8 in. line. This would take 100,000,000 poods per year and only five stations would be needed: Baku, Sageiri, Kiuriuk-Tchai, Salogli and Makret, with Batoum receiving. Eleven stations would be abolished. (Two of these, Gori and Evlach, as lowering the efficiency of the pipeline and decreasing its normal work, are to be suppressed.)

The benefits of this variation are as follows:—

1. Eleven power stations with installation of more than 6000 h.-p., a reservoir capacity of 8,000,000 poods and 300 versts of 8 in. line pipe could be used for the Grosny-Novorossisk or Grosny-Tuapse line.

2. Transferring the pumping to the 12 in. line could be done gradually and without any stoppage of work.

3. The increased delivery capacity of the Baku Batoum pipeline to 100,000,000 poods yearly, and the construction of the Grosny-Black Sea pipeline for not more than 50,000,000 poods could be effected at a minimum cost—at a rough estimate not more than 25,000,000–30,000,000 roubles for both—by taking advantage of the power installation of the existing Baku Batoum pipeline and acquiring 850 versts of new 12 in. line pipe, costing about 18,000,000 roubles.

New engines, pumps, boilers or reservoirs are not needed.

4. With 850 versts of 12 in. pipe ready, the realisation of both pipelines could be accomplished in a year—at most one and a-half years.

5. With ripened necessity for increased pumping capability, such could easily be enhanced to 170,000,000 poods in the first direction (four additional stations) and to 75,000,000 poods in the second (10–12 additional stations). T. W.

BAKU OIL INDUSTRY. I. N. Strieshjov, Director of the Baku Petroleum Industry on the Azneft. *Russ. Oil Bull.*, p. 2, September 1, 1924.

The Baku Oil industry during the past four years has been gradually recovering, but the recovery is still incomplete. Production has increased to 23,000,000 poods per month, approximately 60 per cent. of pre-war. Two thousand wells of those exploited before the war are still idle. Drilling accomplished was, in July, 3292 sagènes; June, 4326 sag. This also is a little more than half pre-war rates. A large amount of renewal work is still in front and much labour will be needed in the struggle with the flooding of the oil horizons. Some progress on this point has been

noted in Baku, but the balance of renovation will have to be carried out by other methods, such as adopting the American system of production.

One of the chief problems for the rational development consists of the transferring baling wells to pumping. In April 30 pumps were in use; this has now reached 90, a progress for the summer which cannot be considered especially quick. The cause of the delay is the non-delivery from America of pumps, rods, pipes and other equipment. The pumps, existing and being installed in Baku are of local manufacture of the old pattern and are not satisfactory. Motors are not sufficient in number, and in many cases those installed are much too large.

Another important problem is reviewing the construction of the wells with a view to decrease the diameter; augmenting the rapidity of drilling and lessening of costs are also being worked out. New wells of such large diameter as formerly are not now projected, and it is believed that a substantial progress will be made in the near future.

A third problem—supplanting rod-drilling with rotary and cable—is now being realised. Rotary drilling, which during the past winter amounted to very little, is now in order, and there are occasions of very quick drilling, but the present rate is very small—about 22 sag. per month per rig. In Baku, on the Bibi-Eibat field a cable drill, commenced in March, is now only 190 sag. deep, which is not a great speed. The starting casing 28 in. was too large a diameter and should have been 20 in. Cable drilling in Bibi-Eibat has successfully passed through strata, formerly considered difficult.

A fourth problem is the evaporation of light fractions in the crude oil, and this has reached a high measure on the oilfields. It is calculated that the average loss is not less than 3 per cent. benzine of the gross production of the petroleum. With a gross production of 300,000,000 poods this loss equals approximately 10,000,000 poods, amounting to about 15,000,000 roubles per year, which could be saved if the whole course of the oil from well to refinery could be hermetically sealed. With this view 400 wells are to be equipped in the coming year.

The next question concerns natural gas. The position in Baku in March and April was that there was little gas, this fact being explained by the small amount of drilling. Gas is pre-eminent in new-drilled wells, and while for the past seven years very little drilling took place, it follows that there were few wells abundant in gas. Drilling is now augmented, being 37,000 sag. for the current year, with 40,000 sag. for the next year; and among these new wells there may be some with a large quantity of gas, and it only needs some method of capping a vigorous gas fountain. In general, the utilisation of gas in Baku is a serious question, and in the next year the erection of two gasoline works to produce benzine are projected.

Thanks to its benzine, Grosny has become a profitable undertaking and Azneft must proceed along the same lines. Overcoming the evaporation problem and distilling light benzene from gas, Baku would increase its benzine products many times as compared with its present figure.

T. W.

EMBA. *Russ. Oil Bull.*, p. 5, September 1, 1924.

The administration of the Emba oilfield, hitherto centred in Guriev has now been transferred to Dossor-Guriev, remaining the forwarding point for all goods coming from Astrakhan. The production of oil for the current year is expected to reach 7·5 million poods, 95 per cent. of the estimated quantity of 8·1 million poods. This deficiency is owing

to the slow drilling during the first six months; for the last few months the drilling is more rapid, and the estimate will probably be reached—655 sag.

The export of oil from the fields proceeds normally, and by the end of the navigation all stocks of crude will be exported. It is proposed to export also, approximately, 400,000 poods of kerosine distilled previous to the revolution.

Some prospecting drilling has been done this year at Tas-Kuduke, a well being drilled to 130 sag. At 98 sag. a benzine sand was met. Further testing of this well is now taking place, and as soon as this is completed a new well will be drilled.

A gross production for the year 1924-25 is estimated at 9·8 million poods, with 80 wells in exploitation (current year 56). Drilling is estimated at 1200 sag. and prospecting drilling at 400-480 sag., with two wells to be drilled in Tas-Kuduke and one in Makati.

It is estimated that the amount of crude oil distilled will be 6,000,000 poods, with approximately 600,000 poods of kerosine and about 750,000 poods of special sorts of oils: vaseline, motor, oil for superheated steam and about 700,000 of cart grease, etc. T. W.

Bibi Eibat Bay. D. Damperov. *Petr. and Oil Shale Ind.*, VII, 137, 1924.

Criticising the report of filling in the Bay, two hypotheses are sharply formulated:—

(1) K. Kalitzin—of the possibility of the existence of horizontal coverings and veins of volcanic breccia between the productive masses.

(2) D. Golubiatnikov—of the existence in the productive masses of vertical and similar cleavages filled in with volcanic breccia.

All investigators come to a general conclusion that the expectations of the result of filling in the Bay can be considered not realised. The pessimistic conclusions of K. Kalitzin and D. Golubiatnikov are not justified by the presence of a mud volcano only. On the contrary, this fact can be interpreted into the advantageous possibility of there being, in the Bay, a perfectly inexhaustible part of a bed not yielding in richness to the XX group on the mainland.

The work of Azneft's mining department is greatly exaggerated. Up to the present 29 wells in all have been drilled, a maximum congestion of one well per desatine, while on the mainland the number of wells per desatine amount to six. The whole surface to the south of the crater is scarcely touched with drilling.

Conclusions: There are not yet data enough for denying the richness in oil of the interior of the Bay. The possibility of discovering such rich parts as XX and XIX groups of Old Bibi-Eibat is not yet excluded. Further work should be directed to searching those parts of the Bay, not yet explored, where the damaging influence of the irrupted strata is least possible. The attempt to explore the whole magnificent productivity of the Bibi-Eibat mass by one and the same wells should be dismissed. The commencing diameter of casings should be greatly decreased, owing to which the oil strata will be reached more rapidly with a well constructed more conveniently and more reliable for shutting off water. T. W.

Mud Volcano. D. Damperov. *Petr. and Oil Shale Ind.*, VII, 137, 1924

The author picks out the paper of K. Kalitzin from many others devoted to the structure of the mud volcano as giving not only a digest

of sundry drilling material, but an attempt to approach the question of the productive mass in the Bibi-Eibat beds.

The reasonings of K. Kalitzin do not fully agree with the facts obeservable throughout the length of the Apsheron-Kurinka shores.

The volcano can be looked upon as a complex crater, situated along the axis of the dome, which are united by branches in an upward direction, but it is difficult to decide in which strata the root of the volcano is placed. The assumption of K. Kalitzin, by analogy with the craters of the Baku archipelago, localising them in the lower horizons of the productive masses, is possible, but insufficiently founded. There is a row of refutations against the activity of the volcano being contemporary with the formation of the productive masses. Throughout the whole length of the productive masses while developing, there is not yet known one typical volcanic breccia strata, the formation of which it was possible to consider contemporary with the subsidence of the normal strata of the productive masses.

The characteristical widening of the province of the breccia upwards permits the statement that Bibi-Eibat craters were formed when the basin itself was partly in existence; in any event it is not older than the ancient Caspian terrace. It is probable that the given volcano is not yet extinct. The flows of gas are much too characteristic even for a semi-extinct crater.

The abundance of the productive masses is acknowledged by Andrusov, Bogatchev and many others besides the author; nevertheless Kalitzin, while admitting their marine origin and drawing his own conclusions on oil-bearing therefrom totally disregards these views.

Proofs based on facts are not given of the unreliability of those parts of the filled-in Bay farthest away from the breccia lode and crater, and there are no serious grounds for a pessimistic conclusion. On the contrary, the author does not doubt the reliability of such parts. T. W.

RUSSIA, PRODUCTION AND DRILLING.—*Russ. Oil Bull. Suppl.*, August 8 and October 1, 1924.

Production, 1924, in 1000 poods.

	Jan.	Feb.	March.	April.	May.	June.
Baku	21,670·4	20,569·9	21,766·1	20,665·1	21,513·0	21,656·1
Grosny	8014·0	6873·6	7206·3	6714·8	6946·4	7947·4
Embe	671·6	593·9	637·5	634·4	625·7	544·9
Kuban Black Sea ..	246·5	226·1	241·3	232·6	274·9	304·3
Ferghau	—	—	—	—	—	—
	30,602·5	28,263·5	29,851·2	28,246·9	29,360·0	30,452·7

DRILLING, 1924.

Baku—	Jan.	Feb.	March.	April.	May.	June.
Wells commenced ..	129	137	136	140	151	151
Amount drilled sag.	2458	2405	2121	2617	3323	3927·9
Amount deepened, sag.	313	404	508	480	211	397
Wells deepened ..	57	53	50	50	54	56
Total drilled .. sag.	2771	2809	2629	3097	3534	4325
Amount drilled by rotary .. sag.	1056	1080	852	1121	998	1776
Wells passed into exploitation	7	—	—	10	12	11

Grosny—	Jan.	Feb.	March.	April.	May.	June.
Wells commenced ..	60	61	59	60	63	61
Wells deepened ..	16	14	17	20	22	22
Amount drilled and deepened .. sag.	1504·3	1385·4	1122·6	1263·6	1620·0	1248·0
Amount drilled by rotary .. sag.	104·6	67·0	47·9	222·0	282·5	152·9
Amount drilled and deepened :						
Old Grosny area, sag.	944·4	935·4	—	733·7	899·1	900·8
New Grosny area, sag.	527·0	418·7	—	521·5	688·7	320·4
Voznisenaky area, sag.	32·9	31·3	—	8·4	32·2	26·8
Emba—						
Wells commenced and deepened	1	4	4	6	6	5
Amount drilled sag.	15·6	67·0	59·1	122·2	88·0	85·7
Kuban, Black Sea (including Maikop and Krimsky)—						
Wells passed into exploitation	51	42	53	53	56	55
Wells drilled and deepened	8	8	8	9	8	8
Amount drilled and deepened .. sag.	129·0	145·4	226·1	208·8	93·3	170·3
Amount drilled and deepened :						
Maikop .. sag.	123·0	143·1	226·1	182·4	91·0	160·3
Krimsky .. sag.	6·0	2·3	—	26·4	2·3	10·0

T. W.

THE MINERAL RESOURCES OF INDIA.—Cull and Co.'s *Financial Review*. Vol. 3. No. II. Pp. 7-13.

The agricultural industries are briefly referred to, including the commodities: rice, wheat, barley, millets, maize, grain and other pulses, linseed, rape seed, mustard and other oil-seeds, spices, sugar-cane, cotton, jute and other fibres, tobacco, fodder and garden crops, etc.

OIL REGIONS: ASSAM, BURMA, THE PUNJAB.—(A map of these oilfields is given.)

(*a*) *Assam.*—Most of the petroleum is found along the flanks of the Naga Hills, especially in the districts Digboi and Makum. Exposed rocks consist of Shales, Clays and Sandstones, usually dipping at a sharp angle, unsymmetrically. The petroleum is found in coal-bearing measures of eocene age.

Quality of Oils.—The crude oil (Digboi Field) is found in intermittent deposits situated in loose sands. Gas pressure is high. Heavy or gusher types of well are not found, nor likely to be, but the wells have a long life. The oil brings a large proportion of sand, contains a heavy percentage of wax of a high melting-point, and has a specific gravity of 0·856. It is dark brown, nearly black in colour, and singularly free from water.

Analysis.—

Carbon	86·3%.
Hydrogen	12·9%.
Sulphur	0·15%.
Nitrogen	0·2%.
Oxygen	0·45%.

On distillation the crude oil yields :—

Petrol	16·8%.
Kerosene	30·2%.
Intermediate oils	3·4%.
Lubricating oil base	10·8%.
Paraffin M.P. 57·8° C.	7·6%.
52·2° C.	3·1%.
Sweats M.P. 35·5° C.	8·8.
Residue	19·3%.

The oil from Badarpur is different. It is a natural fuel oil of high specific gravity with total absence of solid paraffins and little asphaltum.

(*b*) *Burma.*—The fields may be divided into two distinct groups : the main field in Upper Burma, and a small occurrence on the islands, of Ramri and Chaduba, near the Arakan coast.

The producing oilfields are situated on both sides of the River Irawadi about midway between Rangoon and Mandalay. Starting at Minbu, the field on the western bank of the river ends a little north of Yenangyat. Most of the oilfields lie on the east bank of the Irawadi : the Yenangyaung fields, 26 miles above Mimbu, and the Singu field about 20 miles higher up. The order of importance is, Yenangyaung, Singu, Yenangyat, Minbu.

The Yenangyaung field forms a rising plateau ; the rock series is of Miocene age and composed of laminated and clayey sands inclining to form soft sandstone. Concretionary masses of sandy limestone predominate. The main supply of Burmese oil is drawn from this rock-epoch.

American geologists predict the waning of the Singu and Yenangyaung production, but consider this may be counteracted by the discovery of new fields, especially in the Arakan coast district, as well as Northern Burma, Chindwin area. At present the Burma fields show a steady production of oil, which constitutes the major part of India's total production of about eight million barrels per annum. (A sketch map of the undeveloped [Chindwin] Northern area of Burma is given.)

Quality of Oils.—The Burma crude oils are characterised by a high content of solid paraffins. The colour is brown by transmitted light, and green by reflected light, with a pleasant odour, and nearly free from water. Its specific gravity is 0·835 ; it contains little sulphur. On distillation it yields :—

Petrol (to 160° C.)	28%.
Kerosene (160°–300° C.)	35%.
Intermediate oil	6%.
Paraffin M.P. 57·8° C.	5%.
,, ,, 52·2° C.	3%.
,, Soft (sweats)	2%.
Lubricating oil base	13%.
Residue	8%.

Burma oil does not readily undergo decomposition by "cracking." The small field of Yenanma produces oil closely resembling that of Yenangyaung.

(c) *The Punjab.*—The rocks worked here belong mainly to the Eocene epoch of the Tertiary period. The Charat region is where the main operations are carried on. The Attock Oil Company state that their production shows an appreciable increase during the last three years. The producing fields are about 45 miles from Rawal Pindi, with which they are connected by a pipe-line.

Commercial Aspects.—Most of the petroleum produced is consumed in the country. It averages about 8,000,000 barrels annually, coming largely from the Singu and Yenangyaung fields of Burma, and from the Attock field in the Punjab, and the Badarpur and Digboi fields of Assam.

Short pipe-lines or tank barges convey the oil to the refining centres near Rangoon in Burma, to Debrugarh and Digboi in Assam, and to Rawal Pindi, in the Punjab.

Imports of petroleum represent 40 per cent. of the annual demand, leaving ample markets in India for any increased production. The two principal items of export from India are gasoline and paraffin wax. The former goes chiefly to England and other European countries, and the paraffin wax to China, Japan and England.

At the present rate of yield these oilfields can maintain their supremacy of supplying oil in India for the next hundred years. The potential oil reserve from the above oilfields is from six hundred to twelve hundred millions of barrels of oil, varying in character and grade.

J. E. M. H.

Chlorination of the Natural Gas of Vaux (France).—H. Gault and H. Benlian. *Chim. et Ind.*, 1924, **272**, (Special number).

Natural gas from Vaux has the composition: carbon dioxide 3·3, nitrogen 4·38, hydrogen 0·49, methane 84·38, ethane 4·70, propane 1·43 and butane 0·73 per cent. On chlorination at temperatures between 245° and 415°, in the presence of ferric chloride and the absence of light, using a proportion of chlorine equal to the methane present in the gas, a mixture of the four possible chlorine derivatives of methane was always obtained. The rate of flow was maintained at four litres per hour.

S. F. B.

The Catalytic Activity of Carbons from Aromatic Hydrocarbons and Some Derivatives.—W. Farmer and J. B. Firth. *J. Phys. Chem.*, 1924, **28**, 1136.

The authors have examined the initial activity of carbons derived from various aromatic compounds after a short heat treatment at 900° in catalysing the decomposition of hydrogen peroxide; also the effect on this catalytic action of previous treatment of the carbons with iodine. Carbons derived from substances containing nitrogen appear to be the most active, but the activity of all the carbons examined increased after iodine treatment. Of the carbons produced from aromatic hydrocarbons, that from anthracene appears to be the most active and that from benzene the least.

S. F. B.

DEHYDROGENATING ACTION OF NICKEL-COPPER CATALYSTS.—G. Kita, T. Mazume and K. Keno. *Chem. Umschau*, 1924, **31**, 165-167.

Catalysts deposited on kaolin have been prepared containing varying proportions of copper and nickel ranging from nickel 16·9 per cent. and copper 3·1 per cent. to nickel 10·5 per cent. and copper 9·5 per cent. It has been found that in the presence of these catalysts at 300-310°, stearic acid does not suffer dehydrogenation but ketonic decomposition takes place, the extent to which this occurs increasing with the percentage of copper present in the catalyst. Dehydrogenation of the fatty acids present in herring oil at 170° and 200° occurs with those catalysts containing the larger amounts of copper, but nickel, or nickel containing only a little copper leads to hydrogenation. Catalysts containing small quantities of copper show slight dehydrogenating effects at 100°. The temperature at which the catalyst is reduced is important, for a catalyst reduced at 340-350° showed slight dehydrogenating activity at 100°, whereas one reduced at 220-230° showed none at any temperature. S. F. B.

CATALYTIC ACTIVATION OF ETHYLENE BY AN ORGANO-NICKELIC COMPOUND. —A. Job and R. Reich. *Comptes rend.*, 1924, **179**, 330–332.

The addition of small, successive quantities of pure nickel chloride to magnesium phenyl bromide in ethereal solution at 6° in the presence of pure dry ethylene, leads to the rapid absorption of the gas. The rate at which the gas is absorbed is proportional to the magnesium phenyl bromide present and not to the nickel chloride added. The action of water on this solution leads to the formation of ethane mixed with numerous liquid hydrocarbons. The catalyst is probably an organo-nickelic derivative. S. F. B.

PYROGENIC DISSOCIATION OF HEXADECENE.—H. Gault and Y. Altchidjian. *Comptes rend.*, 1924, **178**, 2092–2095.

The authors have examined the thermal decomposition of hexadecene, prepared by the distillation of cetyl palmitate, using the apparatus described in the introductory paper (*cf.*, *Comptes rend.*, **178**, 1562). The decomposition products consist of hydrogen, paraffins and ethylenic hydrocarbons. The percentage of the unsaturated hydrocarbons increases with rise of temperature until a maximum of 67-68 per cent. is reached; above this temperature the yield decreases. There is a corresponding minimum for paraffins. Rise in temperature also increases the percentage of hydrogen. The results obtained indicate that although the size of the furnace does not alter the general effect, yet the range over which corresponding results are obtained is altered. Thus the maximum yield of unsaturated hydrocarbons with a 64 cm. furnace is at 570°, but at 685° with one of 16 cms. length. S. F. B.

PYROGENIC DISSOCIATION OF HEXADECANE.—H. Gault and F. A. Hessel. *Comptes rend.*, 1924, **179**, 171–173.

The effect of varying the temperature and the length of the furnace on the pyrogenic decomposition of hexadecane, prepared from hexadecene by hydrogenation (v.s.) has been investigated. Increasing the temperature from 600–815° increased the percentage of hydrogen and saturated hydrocarbons, but decreased the percentage of unsaturated hydrocarbons. Acetylene was detected in the products formed at 615°, and in some experiments at an even lower temperature. Only in one case were

aromatic hydrocarbons detected when tested by the method of solubility in dimethyl sulphate. Figures are given for the densities, iodine absorption and refractive indices of the products. S. F. B.

KINETICS OF DEHYDROGENATION CATALYSIS II.—N. Zelinsky and G. Pavlov. Ber., 1924, **57**, (B), 669–671.

The authors have compared the relative efficiencies of platinum and palladium in catalysing the dehydrogenation of *cyclo*hexane and of piperidine. With the latter, palladium appears to be the more energetic catalyst, but dehydrogenation is limited to temperatures up to 250°, above this, side reactions weakening the effect of the catalyst. Dehydrogenation commences at 150° with either platinum or palladium, but between 150° and 200° palladium acts more energetically with piperidine than with *cyclo*hexane, the proportion of hydrogen eliminated being higher. S. F. B.

SILVER AS CATALYST FOR THE ABSORPTION OF ETHYLENE BY SULPHURIC ACID.—W. Lommel and R. Engelhardt. Ber., 1924, **57**, (B), 848. (Compare Br. Pat., 185,757.)

The reaction proceeds in two stages. The first is the addition of ethylene to the silver salt, a reaction which occurs very rapidly even at room temperatures, and the second, the formation of ethyl hydrogen sulphate. The latter is a much slower reaction which only attains a satisfactory rapidity at 40°. Proof of the first stage is shown by the fact that the ethylene can be removed by evacuation. Similar addition products are also formed in aqueous solution in the absence of sulphuric acid; thus silver nitrate in 15 per cent. solution absorbs 0·25 mol. of ethylene, but the vapour tension of this solution is considerably lowered by the addition of a small amount of acid. Silver sulphate in sulphuric acid (3 per cent.) absorbs one molecule of ethylene. With phosphoric acid the tension is so lowered that the method can be used for analytical purposes, a solution of silver nitrate (10 per cent.) in 4 per cent. phosphoric acid giving the same results as those obtained by the Hempel bromine method. S. F. B.

DEHYDRATION OF ALCOHOL. THE SYSTEM WATER-ALCOHOL-HYDROCARBON-POTASSIUM CARBONATE. EQUILIBRIUM BETWEEN THE THREE LIQUID PHASES.—L. Gay, P. Mion and Servigne. *Chim. et Ind.*, May, 1924, (Special number), 286–295.

The equilibrium between water, alcohol and liquid hydrocarbons has been examined theoretically. Experiments have confirmed the general conclusions reached.

The quantity of alcohol in the hydrocarbon layer is independent of the concentration of potassium carbonate in the aqueous layer, providing that this concentration does not exceed 30 per cent. At 20°, the solubility of potassium carbonate is too low to render the alcohol and hydrocarbon miscible. The solubility of an aqueous solution of a good dehydrating agent in the alcohol-hydrocarbon mixture must be negligible, or the alcohol must be almost insoluble in the aqueous solution of the dehydrating agent. A solution, containing 45 per cent. of potassium carbonate, is sufficiently concentrated to fulfil these conditions. S. F. B.

ORGANIC REACTIONS AT THE SURFACES OF DEHYDROGENATING CATALYSTS.—H. Adkins and W. A. Lazier. *J. Am. C.S.*, 1924, **46**, 2291–2305.

The reduction of nickel compounds by ethyl alcohol leads to the formation of a catalyst having different properties to one produced by reduction

with hydrogen. Although the difference, in their ability to promote hydrogenation of ethylene, is little marked, they differ considerably in their power to dehydrogenate alcohol and to break down the C–C linkages in acetaldehyde and other compounds. Unlike metallic oxides, the catalytic activity of which varies with the substances from which they are produced, the activity of nickel is determined by the method of reduction. The lack of evidence that the presence of oxygen is necessary for a nickel catalyst to act, proves that it is metallic nickel and not the oxide which is active; the fact that oxygen activates nickel must not be taken as proof of the oxide-catalyst. It appears that the spacing of the active points on a nickel catalyst surface is a matter of fundamental importance. The ability of nickel catalysts to bring about disruption of the c-c leakage is characteristic. S. F. B.

DIRECT SYNTHESIS OF HIGHER FROM LOWER HYDROCARBONS. PART I.—Science, 1924, **60**, No. 1555.

Ethane, under the influence of the α-radiation from a small quantity of radium emanation (niton) mixed with it, is rapidly converted into one or more higher hydrocarbons. After one day's action, a reddish-brown liquid appeared in fine drops on the walls of the containing-vessel, but the quantity obtained was too small for identification. It was found to have a vapour pressure approximately equal to that of octane, one of the first liquid hydrocarbons. The reddish-brown colour of the liquid is probably due to the presence of colloidal carbon showing that some decomposition of the hydrocarbons present also occurs. After several days, the pressure had risen considerably, but on examination nothing other than the liquid and hydrogen could be found. The pressure continued to rise, however, a fact attributed to the further action of the α-particles on the liquid. No solid hydrocarbons were observed. A possible explanation is given, based on the ionising effect of the α-radiation. S. F. B.

NEW CONTRIBUTION TO THE OXIDATION OF PETROLEUM.—C. Cândea. *Mon. Petrole Roumain*, 1924, **23**, 1295–1303.

In order to find the best conditions for the formation of aromatics, benzines boiling up to 150°, obtained from five different crude Roumanian petroleums, were heated in a glass tube 65 cms. in length and 12 cms. in width. In the presence of oxygen with ferric oxide as catalyst, the optimum temperature was found to be 250°. The highest yield of aromatics obtained was 6·4 per cent. S. F. B.

THE FORMS OF SULPHUR IN COKE.—A. R. Powell. *Fuel*, 1924, **3**, 408–416.

A phase rule study of the sulphur held by carbon at high temperatures. It has been found that the sulphur in the carbon-sulphur system occurs in two forms: (*a*) adsorbed free sulphur, and (*b*) sulphur in solid solution. S. F. B.

A BOILING POINT CORRECTION CHART FOR NORMAL LIQUIDS.—W. H. Bahlke and R. E. Wilson. *Ind. Eng. Chem.*, 1924, **16**, 1131–1132.

Vapour pressure curves for the normal paraffin hydrocarbons from *n*-pentane to *n*-tetracosane have been made, and a chart prepared from them covering the corrections to be made to the boiling point when the distillate is carried out at any pressure other than that at which it is required to know the boiling point. As this chart may be used with reasonable accuracy for any normal (*i.e.*, non-associated) liquids, it should be particularly valuable in correcting the boiling point

temperatures observed in standard Engler distillations when the barometric pressure is considerably different from that at the place where the oil is to be consumed. Tests carried out on a sample of gasoline showed that the corrections found from the chart more closely approximated the observed differences than did the corrections calculated from Young's equation. S. F. B.

SILICA GEL: PREPARATION, NATURE AND USES.—J. H. Frydlender. *Revue des Produits Chimiques*, Sept., 1924.

A general review of the history of the subject up to the present day. A useful compilation of facts and figures for anyone desirous of studying the subject. F. G. P. R.

DIRECT UTILIZATION OF LOW-TEMPERATURE TAR BY THERMAL TREATMENT.—F. Fischer, H. Schrader and C. Zerbe. *Chem. Abstr.*, **18**, 2800.

An investigation of the possibility of separating the phenols from the hydrocarbons in low temperature tar by simple thermal treatment. Tar fractions 200–250° and 250–300° were heated at temperatures 500°, 600°, 700° and 750°, and corresponding phenol and hydrocarbon fractions were similarly treated. The most suitable temperature appears to be 600°. Naphthalene in considerable amounts was obtained in the products of experiments at 700–750°, more from the hydrocarbons than from the phenols. R. P.

METHODS OF PURIFYING HEXANE, ETHER AND ALCOHOL.—A. Castille and V. Henri. *Bull. Soc. Chim. Biol.*, 1924, **6**, 299–302.

Using the ultra violet absorption as a test for purity, methods for purifying hexane, ether and alcohol have been devised and are described. Hexane can be obtained in a pure condition by treating petroleum ether, boiling between 65–70° with sulphuric acid, sodium hydroxide, alkaline permanganate and acid permanganate solutions successively. The hexane is then thoroughly washed with water, dried over metallic sodium and fractionated. S. F. B.

HYDROCARBONS AND CARBON CHLORIDES. III.—THE SOLUBILITY OF, IODINE IN CHLORINATED HYDROCARBONS.—B. M. Margosches, Wilhelm Hinner and Ludwig Friedmann. *Z. Anorg. Allgem. Chem.*, 1924. **137**, 81–90.

The solubility of iodine in chlorinated hydrocarbons decreases with increase in the extent of chlorination. It has been found that with a large number of chlorinated hydrocarbons, the solubility increases with rise of temperature in a definite manner. S. F. B.

ACETONE AND OTHER KETONES FROM SECONDARY ALCOHOLS.—A. A. Wells. U.S.P. 1,497,817 of June 17.

In the production of ketones from the secondary alcohols obtained by hydrolysing solutions of cracked gases in sulphuric acid (S.G. 1·7–1·8), the alcohols can be oxidised by steam and air in the presence of a catalytic material of suitable heat conducting capacity to prevent overheating. Copper in the form of tubes, rods, etc., can be used providing the surface is first prepared by successive oxidation and reduction. Other examples are given. S. F. B.

ACTIVATING CARBON.—J. C. Woodruff and T. L. Wheeler. U.S.P. 1,505,517 of Aug. 19.

Carbon is activated by treatment at an elevated temperature in such a manner that all the carbon comes in contact with the oxidising agent

before it can be contaminated with oxidation products. The carbon is heated to the temperature necessary for activation by means of the hot combustion products. S. F. B.

ACTIVATING CARBONACEOUS MATERIALS.—N. K. Chaney. U.S.P. 1,497,543 of June 10.

Low-temperature cokes, animal or vegetable charcoals, etc., composed largely of active carbon on which there is a large amount of adsorbed matter and which are thereby rendered inactive may be activated by calcination at a low temperature in order to avoid the formation of inactive carbon. The material obtained is then partially oxidised, with air or chlorine and steam, until a carbon, having a definite retentive capacity for chloropicrin, is produced. S. F. B.

PREPARATION OF DIETHYL SULPHATE FROM ETHYLENE.—Carlo Maimeri. E.P. 215,000.

Diethyl sulphate may be prepared from ethylene, freed as far as possible from diluting gases if present, by absorption in sulphuric acid monohydrate at 65–75° under a pressure of approximately fifteen atmospheres. No catalyst is necessary. S. F. B.

IMPROVEMENTS IN APPARATUS FOR MAKING METAL CATALYST.—R. W. Barker. E.P. 222,922.

An apparatus is described for producing a non-oxidising nickel catalyst in the form of a black flaky powder. A solution of nickel nitrate and sugar is fed into a muffle furnace, through which an inert or non-oxidising gas is passing. S. F. B.

PROCESS OF RECOVERY AMMONIA FROM GASES AND VAPOURS.—W. A. Bone and G. I. Finch. E.P. 222,587.

Ammonia may be recovered from gases or vapours by absorption in a solution of phosphoric acid, ammonium dihydrogen phosphate or a mixture of both, under such conditions that di-ammonium hydrogen phosphate crystallises out and can be separated. The ammonia can be recovered by heating the crystals, the residue being returned to the solution. S. F. B.

IMPROVED PROCESS FOR TREATING VEGETABLE MATTER BY FERMENTATION TO OBTAIN ALCOHOL, ACETONE AND OTHER PRODUCTS.—H. R. Norbury, P. H. Desborough, A. C. Thaysen and L. D. Galloway. E.P. 222,549.

Vegetable matter, in the form of grass or straw, is heated with dilute mineral acids to convert the insoluble pentosans into soluble pentoses, the residue cooled to between 30° and 45° C., neutralised with alkali until the concentration of hydrogen ions is just on the alkaline side of the neutral point and inoculated with Bacillus acetoethylicus (Northrop) S. F. B.

IMPROVEMENTS IN EJECTOR APPARATUS FOR RAISING OIL FROM WELLS.—E.P. 22,536.

The object of this invention is to provide a means whereby oil can be raised from wells by utilising the pressure of natural gas. This is effected by means of an eduction tube, placed inside the casing and equipped with a packer to prevent oil and gas from escaping into the annular space between casing and eduction tube. Ejectors are provided and may be operated either by an accumulation of natural gas or by artificial pressure introduced through the casing head. In addition,

by a suitable design of ejector, water and gas can be raised separately from the well, thus preventing the formation of oil and water emulsions. The ejector springs and valves can be adjusted to suit varying pressures of natural gas. W. H. T.

ROTARY DRILLING EQUIPMENT FOR BORING WELLS AND THE LIKE.—214,605. E. P

The object of this invention is to provide the drill stem bushings with improved means for preventing their accidental withdrawal when raising the drill stem. A further object is the provision of improved locking means which is readily installed and removed as desired. The invention consists of a bar with a substantial hook at each end, the hooks being adapted to fit into slots in the rotary table. The bar abuts the drill stem bushings and prevents the latter leaving their seats. An additional safety rod prevents the removal of the bar. W. H. T.

THE SMOKE ABATEMENT CONFERENCE.—*J. Soc. Chem. Ind.*, **43**, 46, 1119–1125, Nov. 14, 1924.

An account of the Conference and Exhibition arranged by the Smoke Abatement League in Manchester and which opened on November 4th, 1924.

Sir F. Baines, Director of H.M. Office of Works, speaking on the effect of atmospheric impurities on buildings, stated that his Department spent over one-and-a-half million pounds annually in looking after Government buildings, 30 to 40 per cent. of which would be saved if we had an acid-free atmosphere.

Mr. R. Maclaurin described the Maclaurin smokeless fuel plant erected at Glasgow. Working with Scotch coals (6–10 per cent. moisture, 30–35 per cent. volatile matter), about 55 per cent. of smokeless fuel had been obtained. Not less than 25,000 cu. ft. of gas of 240 B.Th.U. average calorific value was guaranteed per ton of coal, the quantity of gas made regulating the type of coke produced. A highly phenolic crude oil was obtained, containing paraffins, olefines, some aromatic compounds, basic bodies and phenols, but no benzene, naphthalene or anthracene, and little or no petrol. Ammonia averaged 17 to 30 lbs., and contained a considerable proportion of polyhydric alcohols.

A number of papers were read dealing with smokeless fuel and the low-temperature carbonisation of coal, and brief particulars are given. The article concludes with a description of some of the exhibits which were on view during the exhibition, including a model of the "Fusion" retort for the treatment of oil-shales, etc., and a demonstration of fuel-oil advantages by Messrs. Shell-Mex, Ltd. G. S.

LE PÉTROLE EN YOUGOSLAVIE.—Georges F. Rupalley. *La Revue Pétrolifère*, Oct. 11 and 18 and Nov. 8, 1924.

The area of Jugoslavia is about 250,000 square kilometres. It lies between longitudes 13½° and 22¾° E. of Greenwich, and between latitudes 41° N. and 47° N.

This kingdom of Servians, Croats and Slavonians is formed by the union of Servia with Slovonia, Croatia, the Banat, Baska, Dalmatia, Bosnia, Herzegovina, Macedonia and Montenegro. A map is given with this paper.

The petroliferous region of Slavonia and Croatia is part of the great arc that flanks the Carpathians, spreading through Poland, Roumania and Jugoslavia to end on the border of the Adriatic.

Before the war Austria prevented the development of her southern Slav provinces in favour of Poland and Galicia, but the future of Jugoslavia seems very promising. The very names of villages and streams are suggestive of Oil, or Bitumen, and the peasants have utilized the seepage oils or bitumens from time immemorial, and various small borings have yielded oil.

During the war Austria studied this country and sank a well 800 metres deep at Selenitza which yielded 7½ tons of oil hourly. To the south at Bujarvic petroleum and gas were obtained in quantity.

General Geology.—The author deals in more or less detail with each of the many geological formations that are represented. A geological map is given of the territory.

Petroliferous Zones.—There are two distinct lines: (1) the Northern, with light naphtha and ozokerite; (2) the Southern, with much gas, oxidized naphtha and bitumens.

The former follows the rivers Mur and Drave to the junction of the latter with the Danube, the latter follows the rivers Sam and Save, crossing Croatia, the extreme north of Bosnia and Slavonia to the neighbourhood of Vinkovski.

Both these lines are parallel, roughly.

Exploitation Work. (*a*) *Northern Line.*—Near *Muraszombat*, north of the River Mur, gas and oil occur in the hills, which extend to Felsolenava—perhaps connected with the small Hungarian oil basin of Letenye—parjayoil at 700 m. is met with here.

At *Medjmurje.*—This region is bounded on the north by the River Mur and south by the Drave, a band of 20 kilometres surrounding part of Mt. Kollas, and south of Ludbreg (which is at the junction of the Mur with the Drave). It follows the Drave to the Danube, which it then follows as far as Fruska-Gora. Numerous seepages of naphtha occur, along with ozokerite, saline and iodized springs. A Jugoslav society has worked on a petroliferous horizon (Pliocene) depth, 130-150 metres, for more than fifteen years past. A light oil of density 0·85-0·87 was obtained; the yield was some 500 kilogrammes daily.

Selenitza.—Here the first horizon of oil sands is between 130-5 and 133 m., the heat at 400 m. with gas and petroleum. The yield has been about 7000 tons up to the present.

Polstrau.—Taking Selenitza and Ludbreg as the base of a triangle, this is the apex to the west, it is a little north-east of Mt. Kolbos. The "Bitumen" Company has sunk to 350 m. without encountering gas or oil: the author states that these are two parallel anticlines running east and west near Selenitza, and that the experts have drilled a little too far from the summit of the southern anticline.

Ludbreg.—A well 100 m. in depth encountered oil at Velica-Paganez. In this vicinity an ozokerite bed 0·45 m. thick was found in a 90 m. well. Many seepages of naphtha occur. The structure seems to be a series of domes.

Pitonamca.—Here an Anglo-Jugoslavian Co., D.D., affiliated to the "Shell," has sunk a well 813 m. deep, and encountered five petroliferous horizons (A section is given.)

At *Bielo Brdo*, at 136 m. depth, much gas and a light naphtha were encountered.

(*b*) *Southern Line.*—North and south of *Zagreb* small borings gave water and methane, and a little further east at *Moslavina* and *Miklenska* (to the north of the River Save) wells were sunk, yielding an oxidized naphtha, which seems to arise from depth, by a fault.

Uljanic.—At Bujanca the Nljanic Co., D.D., has drilled thrice a Pliocene dome. In this first hole gas issued at 284 m. and 353 m. and oil at 396 m. In the second gas issued at 332·5 m. and 398 m. and petrol at 407 m., gas and oil at 417 m. and gas again at 586 m. and 851 m. In the third hole traces of oil occurred at 275 m., a gas horizon at 362 m., and oil at 393·6 m.

All these borings are remarkable for the formidable pressure of the gases, which increased with depth.

At *Nova Gradiska*, south of the River Save, potash waters and methane (CH_4) have been obtained by drilling.

At *Tugla*, in Bosnia, a petroliferous zone at slight depth has been proved to exist. Salt is worked here by pumping the brine from wells from 200 m. to 450 m. in depth

Interesting indications of naphtha are stated to occur also in *Montenegro*, at Bukovik and Snirdes, and in *Macedonia*, near Horid and Bucin.

Deductions.—The Miocene is the formation actually known as petroliferous, and the Tortonian-Helvetian is the chief repository. The Sarmatian (Upper Miocene) and Pontian (pre-Pliocene) form a small upper horizon at about 250 m. The Helvetian and Sarmatian (estuarine facies of Tortonian) will yield pretroleum rich in the lighter varieties with good benzine and paraffin content. This horizon would extend from 250 m. to 700 m., the Upper Helvetian series starting at about 500-700 m. Oligocene and eocene from 700 m. to 1200 m., according to drill locations.

Conclusions.—The same sedimentary strata under similar tectonics occur in Jugoslavia, as in Roumania and Galicia; these three regions having a similar general facies, apart from volcanic phenomena.

Drilling and methodical geological research should lead to the successful location of oil, with good remuneration upon capital expended.

J. E. M. H.

THE GALICIAN PETROLEUM INDUSTRY—PAST AND PRESENT.—*Petr. Times*, Nov. 1, 1924.

This is one of the oldest petroleum industries in the world, dating back as far as the sixteenth century, when the town of Kronso was granted a royal charter to use a mixture of flax oil and mineral oil for the purpose of lighting the town.

The presence of mineral oil in the Ruthenian Carpathians was known in the seventeenth and eighteenth centuries, and wells of oil are recorded at Weglowka and near Drohobycz.

The first Galician company for exploiting petroleum was founded at Drohobycz early in the nineteenth century.

The cradle of the Galician oil industry is said to have been Bobska, where wells were sunk and oil obtained; since then numerous wells have been put down.

The oil deposits of Galicia are connected with the flexured strata stretching eastward along the Polish Carpathians. These flexures form a number of roughly parallel anticlines and synclines in rocks composed of chalk, Eocene and Oligocene strata, each of which is oil-bearing. The width of the oil-bearing zone varies between 200 and 500 metres, and the productivity varies in different territories. About forty oil zones have been exploited in the Polish Carpathians, stretching along a length of about 500 kilometres (310 English miles).

Deeper wells followed upon the adoption of American drilling methods in 1862, and great progress followed the introduction of the Canadian system in 1884. New oil zones were then tapped as in Eastern Galicia,

then Schodnica and Boryslaw, and lastly the Tustanowice field was opened up.

In 1880 oil was found in the Krosno oil zone of Western Galicia and at Potok. It is believed that these western oil zones have a great future.

The largest output of oil from Galicia was in 1909, when 2,086,340 metric tons were produced. J. E. M. H.

GEOLOGICAL.

NOTES ON THE CLINTON SANDSTONE IN OHIO.—J. R. Lockett. *National Petroleum News*, Oct. 29, 1924. Vol. 16, No. 44, pp. 78–83.

This sandstone is one of the greatest sources of natural gas in the world, and produces over one million barrels of high-grade oil per year.

The fields lie between central Huron and western Stark counties to the north, and northern Jackson county to the south.

The "Clinton" dips rapidly to the south and east along the western slope of the Appalachian geosyncline. In Huron country it is about 1500 ft. in depth, whilst the deepest gas-producing well, near Mineral City, Tuscanawar county, is 5200 ft. deep.

The sand is absent in southern Jackson county, and through southern Vinton and Athens counties it is wet; elsewhere the water is inconsiderable. At present little is known geologically about the Clinton sandstone in Ohio, and Clinton drilling based upon surface structure has been generally unsuccessful.

Through central Ohio new pools are opened up from time to time in the Clinton sand, but mainly by taking a chance. The structural relation of the Clinton to the surface beds may depend to some extent upon folding, which could have affected the Clinton horizon before the deposition of the later Palæozoic rocks.

The Clinton fields, as stated above, lie on the west of the great geosyncline formed by the close of Ordovician time by the Taconic Revolution in the east and the Cincinnatian Uplift farther west—the syncline measuring from 200–300 miles across. By the close of the Palæozoic the sediments deposited in this trough measured from probably less than 1000 ft. on the western edge to 6000 or 7000 ft. in Pennsylvania and West Virginia.

The Appalachian Revolution next caused folding, which extends in a more or less marked degree as far west as central Ohio.

It is unlikely that structural conditions 5000 ft. deep in the Clinton region are similar to those found near the surface. The lateral pressure from the east would probably cause broad regional folds below, owing to the great weight of overlying strata.

The greatest factor in determining the relation between the structure of the Clinton and that of the surface beds is probably the rapid thickening eastwards of the Devonian shales and the "Big Lime," amounting to from 30 to 50 ft. in a mile. This expansion is fairly constant in rate as far east as Guernsey county. Probably few surface anticlines in the eastern part of the State have sufficient back dip to warrant the plotting of more than a terrace in the Clinton when this expansion is considered.

The horizon of the Clinton sandstone seems to be irregular; the author is of opinion that it should be considered as a distinct formation of the Oswegan series, or as a separate member of the Medina formation, and therefore that it was amongst the first deposits after the intense deformation at the close of the Ordoviciars. This would lead to the possibility of structural differences due to deposition over a lately

folded surface more or less eroded. He also considers that they were either continental or very shallow water deposits; they are usually red or red-brown in colour. The Clinton is not a uniform consistent bed, but a series of at least three lenticular beds, which diverge and converge, pinch out or join together very suddenly.

The thickness of the beds may vary from a mere show of sand to over 60 ft. Such beds may be encountered anywhere between the bottom of the "Little" Lime and the Red Medina shales. This interval is from 75 to 150 ft., and can be said to be the horizon of the Clinton sandstone. The oil and gas in the Clinton must then have been from shales between the "Little" Lime and Red Medina shales, and probably resulted from the heat and pressure generated at the time of the Appalachian Revolution. Their evolution then follows the general strike of structural deformation, whilst their local sand accumulation is controlled by the individual structure of the Clinton sandstone, which is depositional and cannot be determined from the surface.

The greatest geological problems are in the Clinton horizon, and as yet remain unsolved. Explanations are required of the sudden cutting off of production, the great variation in rock pressure between adjacent wells, the short life of certain wells of good volume and the same pressure as older wells in the immediate vicinity, and the occurrence of oil in the very heart of gas fields at a higher level than the gas.

J. E. M. H.

Determination of Core Samples in Core Drilling.—Albert C. Rubels. *Oil News*, **12**, 412-413, 434, Oct., 1924.

This paper deals with the technical difficulties of obtaining representative cores. It is stated that the length of core recovered rarely represents more than 75 per cent. of the formation cut. Examples are cited from the Los Angeles Basin, in which 181 cores were recovered out of 186 runs. The average distance drilled by the barrel was 55·2 ins., and the average length of core recovered was 41·8 ins. This is probably above the average for such operations—the drilling being continuous and the operators familiar with the characteristics of the formations and the machinery they used.

The problem is stated thus: If in a 10-ft. run of the core barrel but 2 ft. of shale are recovered, from what part of the 10 ft. does the shale come, and what is the formation in the remaining 8 ft.?

A clue is obtained generally by the condition of the core barrel and the way in which drilling progressed. Various cases are considered:

(1) If in a 10-ft. run the first 2 ft. show shale with a hard shell on bottom, the rest being missing, it is probable that the remainder of the interval was a soft shale or sand—probably washed away and lost, not being able to exert enough pressure on the shell to force it into the barrel. Thus, a formation with alternate streaks of hard and soft material is the most difficult to core.

(2) Owing to generation of *heat* by rotation at the shoe or within the union barrel the core may be completely changed in character and appearance: a loose sand may be "burned" to a quartzite, a sandy shale rendered hard and crystalline, a rich oil-sand burned to a black substance, and a bituminous shale to a coke.

(3) Owing to the "whipping" or "jumping" of the drill pipe the core may be broken up and churned around until it loses its original form and texture. An example was encountered in which the formation consisted of alternate streaks of oil-sand and brown shale, the sands becoming leaner and thinner with depth. It was desired to ascertain

the vertical limits of production. Three successive cores averaging 8 ft. were taken. In each case a very soft, sticky brown shale was obtained, with a few fragments of oil-sand and harder shale disseminated through the mass. (This was logged as "sticky shale.") The relative amounts of the sand and shale could not be ascertained, and the cores were useless for the purpose for which they were taken.

Such results are common, and the so-called "rotten shales" are often due to this cause, rather than from the original formation. Drilling mud is built up in this manner, and under the pressure will become so consolidated as to resemble formation and be similarly logged. Careful examination will generally detect this, however. (Diagrams given.)

In loosely consolidated sands the same "jumping" of the barrel in "rough" drilling causes the sands to break, and the drilling mud is forced into the fractures, giving mud laminations, often logged as "thin streaks of sand and shale." These cases may be detected by there being no break in the mud between the coating of the outside of the core and the laminations within the core, where viewed in longitudinal section.

(4) The contamination of a barren sand by oil-saturated mud constitutes a serious difficulty. If examined immediately after pulling out, a stain of oil can usually be seen around the contact between the drilling mud and the core, the central portion being barren. The oil soon works throughout the entire core, however, and the sand will then show a uniform oil-content.

The reverse condition to the impregnation of a water or dry sand with oil may occur; in this the sand is burned sufficiently to drive off the oil without fusing the sand; there results a grey, barren, or almost barren sand. This is easily detected in a fresh core by the distinctive pungent odour. A core should be split down the centre so as to obtain a complete transverse section; then it may be dug into, and reliable information obtained. The usual procedure is to remove the outside mud-coating and shave off perhaps a quarter to a half inch of formation for test. This is not sufficient. J. E. M. H.

THE COORONG OIL COMPANY OF AUSTRALIA.—Capt. E. de Hautpick, *Petr. Times*, Oct. 18th, 1924, 623-624.

A résumé of a report upon the properties of the company, previously investigated by Mr. E. Clarence Wood, B.Sc., whose work is confirmed, its development being continued in the direction of oil geology. The conditions essential to the occurrence of commercial oil in the order of their importance are thus stated:—

(1) Presence of sedimentary rocks not older than Ordovician.

(2) Sufficiency of carbonaceous sediments of the sapropoletic type, originated from waxy and resinous matter of higher plants.

(3) The nature and degree of metamorphism they have undergone (C. ratios).

(4) The presence of sufficient thickness of sedimentary rocks to form oil basins with solid cover to prevent oil from seeping away, or being pushed to the surface of the earth by underground waters.

(5) Their degree of saturation with salt water.

(6) Such artesian water conditions as do not prohibit the accumulation of oil.

(7) Suitable structural features and textural variations formed by gentle folding or faulting as will arrest the underground moving waters which are the principal agents of oil storage into commercial pools.

In Australia two great classes of organic or biogenic rocks occur: (*a*) coals, originating from peat deposits in fresh water of woody plants, from mosses and ferns which grow in swampy or marshy lakes on broad river flood plains or on coastal plain areas mostly formed in fresh water These ordinary coals are high in oxygen and rich in so-called humic acid compounds. They are therefore designated as "humic" coals. (*b*) On the other hand, decay-resistant elements, such as spore and pollen exines, seed envelopes and certain cuticles, are generally provided with resinous or waxy or oily protective substances. These, as well as the resin grains with which they are in most cases mingled, are all very high in hydrogen, and low in oxygen. The rocks in which they are prominent start as organic muds, sapropelitic in composition.

The author infers from comparison of the gravities of the oil in different formations and regions, with special reference to the stages of regional alteration of the mother rocks and other carbonaceous deposits found in the same formation, that petroleum is a product generated in the course of the geo-dynamic alteration of deposits of organic debris of certain types (waxy and resinous matter of the higher plants) buried in the sedimentary strata. The quantity and character of the oil generated are determined by: (*a*) the composition of the organic deposits at the beginning of its dynamo-chemical alteration; (*b*) by the stage in the progress of the dynamo-chemical alterations of the organic substances; (*c*) by the elimination under certain conditions of the heavier and more viscous hydrocarbons through filtration, incident to migration.

In the Coorong Oil Company area investigated there are organic deposits of the so-called "Moorland lignite," which are visible deposits of a sapropelitic type. Thick beds of unconsolidated mudstones, shales, etc., have also been revealed in this area, examined stratigraphically.

The author passes to a consideration of the origin of the substance known as "Coorongite." Two discoveries only of this substance are recorded in Australia: both appearances synchronised with a period of exceptionally heavy rainfall. The flood waters after evaporation left large quantities of this body on the surface of the ground east of Salt Creek, in a part of South Australia known as the Coorong District. Its chemical characteristics and probable origin have been studied by the late Leonard V. Dalton (London), David T. Day (U.S.A.), and many other scientific men.

The writer has been more fortunate than these authorities in having had the opportunity of studying the conditions *in situ*.

Coorongite occurs in depressed portions of sandy plains occasionally submerged, and is spread upon the ground chiefly near the edges of these depressions at the high-tide mark. It has no connection with the ground on which it is deposited. All the once flourishing vegetation is now dead on the depressed areas, from the lowest forms of moss and lichen to the sturdiest eucalyptus. The affected area exactly resembles a ring-barked paddock. Outside the Coorongite rings the vegetation is abundant and vital and the trees are loaded with blossom. The Coorongite varies in thickness from 1 inch to 1 foot and closely resembles the "paraffin dirt" of the Gulf Coast oilfields of Texas and Louisiana. Coorongite does not contain sulphur, and hence is soft. It is very rich in hydrogen and contains 97·4 per cent. of volatile matter, and only 1·97 per cent. of ash, and 1 per cent. of fixed carbon. There is about 0·5 per cent. of actual moisture present. Deducting it from the volatile matter we have carbon 67·29 per cent., hydrogen 11.23 per

cent. It yields nearly 27 per cent. of soluble constituent, and the residue contains from 30 to 40 per cent. of sand and other mineral matter. The soluble constituent is a clear, yellow, translucent, wax-like solid, softening at 30° and quite fluid at 42°. It dissolves in benzine, ether, chloroform and carbon disulphide, and is insoluble in water and methyl alcohol. It oxidises readily. The soluble constituent is unsaponifiable. Coorongite treated by solvents (*e.g.*, CS_2) gives free mineral oil; thus it must be classified as a special type of bitumen, having the pecularity that its inspissated petroleum content during the process of soldification became associated with vegetable and mineral matter. A ton of Coorongite yields: Motor spirit, 22 gallons; medium oil (illuminating and lubricating), 59 gallons; heavy oils (lubricating), 23 gallons; heavy vaseline oils, 65 gallons; tar, 44 gallons; coke (battery carbons), 230 lb.

The oily distillate gives various oils (thin mobile to semi-solid thick) in the following fractions:—(1) 110°–170° C., 6·3 per cent. by volume; (2) 170°–240° C., 27·3 per cent.; (3) 240°–295° C., 25·1 per cent.; (4) 295°–300° C., 27·3 per cent.; (5) residue 14·0 per cent. (E. Clarence Wood).

During the fractioning there is no distinct "break," hence the oil from Coorongite consists of an intimate mixture of paraffins.

This paper is to be concluded in a later number.

J. E. M. H.

Le Pétrole en Amérique Centrale (Petroleum in Central America). *La Revue Pétrolifère*, September 27, 1924, **16**, No. 96.

The article under this title appeared in the journal, *El Imparcail*, of Guatemala City.

In Guatemala the Lower and Middle Cretaceous (limestone and dolomite) cover the greater part of the departments of Huehuetenango, Quiché and Izabal, as well as an important area in the centre and south-east of Péten.

To the north and centre of Honduras there exist sediments compressed and intercalated between the mountains formed of crystalline elements.

At Costa-Rica the Saint Michel limestone is either Cretaceous or Tertiary, and it is not certain whether Cretaceous rocks exist in the South of Central America.

The greatest extensions of uninterrupted Tertiary sediments are found in Péten department and the north part of Belice. These are not found in Salvador, and only isolated unimportant traces occur in Nicaragua. At Costa Rica the Tertiary again become important, occupying the strip of land separating the Lake of Nicaragua from the Pacific Ocean and stretching south towards Panama.

Sedimentary formations older than the Nicosene in Central America have experienced considerable movements and dislocations, bringing to the surface crystalline selecote, probably altered Palæozoic.

On the other hand the Pliocene and Quaternary rocks have retained their original horizontal position. Vertical displacements have given the actual relief of Central America.

Neither Mexico nor Central America have yielded Petroleum, Asphalt, or other Hydrocarbons in rocks older than the Cretaceous.

The petroliferous zone of Tampico Tuxpan in Mexico is formed of Mid-Cretaceous sediments, and the chief petroliferous horizon of the Tehuantepec and Tabosco-Chiapas fields consist of a Cretaceous dolomitic limestone.

At Guatemala the formations holding Asphalt are Lower Cretaceous

("Coban limestones"). At Honduras, again, the Lower Cretaceous form the sediments.

From what has been said, the existence of Petroleum in the large regions of the centre and north of Guatemala, and in Belice (except at its centre) may be inferred.

The petrographical nature and structure of the Cretaceous and Tertiary sediments to the North of Guatemala are favourable to this view. In these sediments there are two bituminous horizons, that of the Coban limestone (Cretaceous) and the bituminous limestones of Péten (Tertiary). There is a good cover of marl and limestone that will hold in such hydrocarbons as exist in the sandstones beneath.

The Cretaceous beds in Guatemala and in the Alta Verapaz contain numerous folds, faults, etc., whilst the marls and sandstones of the Upper Tertiary found south of Péten and Belice have experienced but little displacement. North of Péten both the Cretaceous and Tertiary sediments are but slightly disturbed, showing a series of wide undulations with a curvative turned towards the south.

Hence it is inferred that in the northern part of Guatemala and in some parts of Belice there is a zone of Cretaceous and Tertiary.

Bituminous beds occur associated with a succession of porous and impermeable tracts, with few faults. Igneous intrusions have not been found. This seems to be the most favourable zone for oil prospecting in Central America. This zone resembles that of Central Texas rather closely. In both zones a series of step faults lead to Tertiary sediments, but slightly inclined. Again, in both, the Tertiary and Cretaceous sediments are lightly undulated, the undulations diminishing as the Ocean is approached.

In Texas the Lower Tertiary contains the petroliferous fields of Domo-Salado. Petroleum exists in the salt-domes of Upper Tertiary of the Mexican Isthmus, of which the Guatemala geological formations are the westerly prolongation (Salines Nueve Serros).

These remarks are based upon the geological studies made by Dr. Carle Sapper, and upon the geological map of North America published by the geological service of the United States. J. E. M. H.

Distillation and Refining.

Action of Petroleum-Refining Agents on Pure Organic Sulphur Compounds Dissolved in Naphtha.—A. E. Wood with A. Lowy and W. F. Fargher. *Ind. and Eng. Chem.*, 1924, **16**, 1116–1120.

The effect of various petroleum-refining agents on typical sulphur compounds has been investigated, both quantitatively and qualitatively. Standard solutions of the amyl mercaptans, *n*-butyl sulphide, diethyl disulphide and thiophene in specially purified naphtha were used for the quantitative tests which were carried out under standard conditions. The desulphurising effect of the reagent and, in some experiments, the sulphur dioxide liberated were measured.

It was found that sulphuric acid reacts with mercaptans to oxidise them to disulphides, which are then only slowly oxidised by the acid. Relatively large amounts of acid are required to remove the mercaptans completely, as much as 40 per cent. being necessary to lower the sulphur content of a solution of amyl mercaptan in naphtha during one hour's action. Below 40 per cent. the sulphur content actually increased. Sulphides and disulphides are, however, readily removed by the acid, but this action is dependent solely on the high solubility of these compounds in the acid and not to chemical action, as in the case of thiophene,

which is removed in the form of its sulphonic acid. Carbon disulphide alone appears to be quite insoluble and able to resist the action of the acid. Hydrogen sulphide is oxidised to free sulphur, which remains dissolved in the oil.

The results obtained with sodium plumbite confirm the observations of Wendt and Diggs (see previous abstract), the addition of sulphur merely increasing the sulphur content. The sensitivity of the reaction appears to be very high; 1 part of amyl mercaptan is 100,000 parts of naphtha, giving a distinct "positive" indication. With the exception of hydrogen sulphide, which is removed as lead sulphide, all the other sulphur compounds examined remained unaffected. Oil containing free sulphur, however, gave a slight indication after six months, probably owing to the formation of hydrogen sulphide.

The action of copper oxide on mercaptans is determined by the temperature, length of treatment and the method employed. The formation of copper mercaptides is very incomplete, and when formed they are unstable, readily reacting with unchanged oxide to give the disulphide and cuprous oxide. They are converted by heat into cupric sulphide and alkyl sulphides, which explains the effectiveness of distilling certain oils over copper oxide (Frasch process). Apart from the mercaptans, hydrogen sulphide was the only other sulphur compound examined which was removed by this agent.

Sodium hypochlorite converts the mercaptans into disulphides and hydrogen sulphide into free sulphur, but no indications of further action were found. On the other hand, carbon disulphide is completely oxidised to sodium sulphate and carbonate, this reagent being the only one capable of attacking it. Contrary to previous statements, hypochlorites appear to be without action on other sulphur compounds.

Aluminium chloride was found to be a very effective desulphurising agent both at room and at elevated temperatures. At ordinary temperatures, additive compounds are formed with mercaptans, sulphides, disulphides and thiophene, but as the temperature increases these are decomposed with the formation of hydrogen sulphide, which can then be removed by other methods. S. F. B.

THE DESULPHURISATION OF MEXICAN OIL DISTILLATES BY "DOCTOR TREATMENT."—D. W. Sissingh. *Brennstoff-chemie*, 1924, **5**, 234.

Earlier investigations (*Chem. Weekblad*, 1922, **19**, 489) proved that the action of sodium plumbite solution and flowers of sulphur leads to a considerable increase in the sulphur content. By redistillation, the sulphur is again eliminated, and large quantities of H_2S are produced. The "Doctor Treatment," as applied in practice, is (in its present form) not applicable to crude Mexican distillates.

In Mexican distillates the sulphur can go into solution. After some months a beautiful sulphur crystal was observed in a distillate which before (after the "Doctor treatment") had been treated with sulphur. Borneo distillates, too, can dissolve sulphur. It would be dangerous to treat with sodium plumbite solution without sulphur, while then the distillate may contain lead or there will be formation of lead containing deposits in the storage tanks. H. I. W.

LIGNITE PARAFFIN OIL, A BENZOL WASH-OIL NOT REQUIRING REGENERATION. —A. Thau. *Gas & Wasserfach*, 1924, **67**, 163.

After removal of paraffin wax from the H.O. and P. fraction of lignite tar, the oil forms a very suitable substitute for heavy gas tar oil in

benzol recovery. It has I.B.P. 230° C., 2 per cent. over at 50°, 40 per cent. at 300° and F.B.P. about 400° C. The set point is −4° C., flash point 100° C. and sp. gr. ·915. The oil separates readily from water, therefore direct cooling water can be employed, and does not require redistillation as it retains its fluidity over long periods. Tar spray and polymerization products from coal gas are insoluble in lignite oil, and can therefore be removed as a sludge. Naphthalene is almost insoluble until a small amount of benzol has been dissolved by the oil, when its solvent power becomes equal to that of coal tar oil. F. G. P. R.

Bauxite as a Refining Agent for Petroleum Distillation.—A. E. Dunstan, F. B. Thole and F. G. P. Remfry. *J. Soc. Chem. Ind.*, **XLIII.**, No. 24, 179 T.

Bauxite is a convenient natural gel which, after roasting, can be used to absorb the impurities present in petroleum. The chemical composition of the bauxite has no bearing on its effectiveness, as different samples of the same composition behave very differently in practice and the value of a sample can only be determined by actual experiment. The property is due to the porous nature of the bauxite which appears to be singularly adapted to the purpose in view. Originally bauxite was used for decolourising kerosene and paraffin wax, and latterly has been used for the removal of sulphur compounds. In 1918 it was recorded that bauxite is a colloidal adsorbent of the first order for organic sulphur derivatives, that freshly ignited bauxite gives the best results, and that bauxite is in itself a sufficient refining agent for kerosene and sulphurous distillates.

The size mesh which the bauxite will pass is a matter of importance; the finer the bauxite the better is the colour removal, whilst on the small scale 30/60 mesh is the optimum size for small scale working. On the works scale 20/40 mesh has to be used to save waste and ensure sufficient contact of the oil with bauxite.

Roasted bauxite contains a large number of microscopic pores, and therefore possesses an enormous surface area and consequent surface energy. When oil comes in contact with freshly ignited bauxite a considerable rise in temperature takes place, a property of value in determining the efficiency of the bauxite. Freundlich's law for adsorption is followed, showing that physical adsorption and not chemical action takes place in the removal of impurities from oil. Experiments show that this applies both in the case of colour and sulphur removal. Bauxite acts as a polymerising agent on unsaturated bodies, and may be used for this purpose in treating cracked spirits containing unsaturated bodies. A cracked spirit, which normally gives a yellow distillate, after being filtered through bauxite gives a colourless distillate and a gum containing residue is obtained. Similarly colourless distillates may be obtained by passing the vapours of cracked distillates through hot bauxite, when the unsaturated bodies are polymerised and retained as gummy substances in the pores of the bauxite.

In the practical handling of bauxite a predetermined volume of oil is filtered through a definite weight of bauxite, the bauxite is then steamed until no further kerosene can be economically removed, fresh bauxite to replace handling losses and the bauxite is roasted in excess of air. Roasting is carried out at 500° in a rotary or other type of furnace which allows considerable excess of air to come in contact with the bauxite. The success of the roasting operation can be determined

by placing about 50 grams of the bauxite in a small brass vessel called an ergometer, and adding 20 ccm. of kerosene at the same temperature as the bauxite. A rise of 16° is obtained with new bauxite and 12–14° with regenerated bauxite. After roasting bauxite must be kept out of contact with moist air before use, and is therefore best cooled and used immediately. The shape of the containers used in filtration is, within reasonable limits, of little importance, and a vessel containing 1–2 tons is a convenient size. As colour compounds are removed before sulphur compounds, the most efficient method of working is to use the filters in series in a counter current manner. No advantage is obtained by increasing the pressure on the oil during filtration, but better results can be obtained if the air is removed from the roasted bauxite by heating in vacuo and then admitting the oil. Under these circumstances more heat seems to be developed and the oil undergoes some cracking.

T. A. S.

THE CHEMISTRY OF "SWEETENING" IN THE PETROLEUM INDUSTRY.—Gerald L. Wendt and S. H. Diggs. *Ind. Eng. Chem.*, 1924, **16**, 1113–1115.

The authors have investigated the action of sodium plumbite solution on various types of sulphur compounds likely to be present in petroleum distillates. They have shown that previous explanations of its action and of the part played by the sulphur generally added during the treatment of oils by it are incorrect. Of the sulphur compounds investigated, hydrogen sulphide and alkyl mercaptans were the only substances which gave a "positive" test, sulphides, disulphides and free sulphur showing no indications whatever. Hydrogen sulphide reacts with sodium plumbite to give a heavy black precipitate of lead sulphide; it can, however, be just as easily and completely removed by caustic soda. Mercaptans react to give a yellow precipitate of the insoluble lead alkyl mercaptide, of the type R.S. Pb. S.R., but in oils this rapidly blackens owing to the oxidising action of the free sulphur always present, lead sulphide and the corresponding disulphide being formed. The latter, being insoluble in the aqueous solution, passes back into the oil, but as it is without further action on the plumbite, the oil is "sweetened," that is, no longer contains sulphur in the form of hydrogen sulphide or mercaptans. The formation of the black lead sulphide on the addition of sulphur, when insufficient is present in the oil, is often a useful indication of the presence of mercaptans in highly coloured oils, the colour of which masks the usual yellow precipitate. It is not necessary for sodium plumbite to be present in order that the oxidation of mercaptans by the sulphur may proceed, for sulphur alone reacts, a fact which no doubt explains the "ageing" of distillates. Higher mercaptans, such as those likely to be present in the heavier oils, do not appear to react nearly so readily with plumbite. This is partially accounted for by the much lower solubility of the mercaptans in the aqueous layer, with the consequent lack of contact between the reacting substances, and also by the greater solubility of the lead mercaptides when formed in the oil. The former may be overcome by the use of alcoholic sodium plumbite, but to overcome the latter the addition of sulphur becomes essential. Pressure distillates generally contain sufficient free sulphur for this purpose, but straight-run distillates require added sulphur.

The black precipitate itself acts as a refining agent. Analysis of a specimen showed it to contain a considerable quantity of adsorbed highly sulphurous oil, as well as lead sulphide, traces of mercaptides and sulphate. From this it would appear that not only does the precipitate act through its adsorptive properties, but it also acts catalytically in bringing the reacting substances into closer contact.

Oils which have been previously "sweetened" often become "sour" on redistillation. This has been shown to be due to the interaction of sulphur and the higher mercaptans not previously removed by plumbite, which reaction experiments have shown readily occurs between 350°–400° F. This difficulty can be obviated either by previously removing the higher mercaptans by alcoholic plumbite or by removal of the free sulphur through the agency of an added lower alkyl lead mercaptide, *e.g.*, lead ethyl mercaptide. A method of analysing oils for free sulphur and mercaptans is given. The oil to be analysed is first treated with acid lead acetate to remove hydrogen sulphide and then divided into two portions. One is treated with lead ethyl mercaptide; after a short time the precipitate collected, washed with acetic acid to remove unchanged mercaptides and the residual lead sulphide weighed. This gives the free sulphur present. To the second portion sodium plumbite and sulphur are added, the precipitate giving the amount of mercaptans present. S. F. B.

Fractional Distillation for the Separation of the Constituents of Petroleum.—W. A. Peters, junr. *Ind. Eng. Chem.*, 1924, **16**, 1126–1130.

The theory of fractional distillation and the mathematical formulæ used in designing fractionating columns are discussed. Experiments are described using a small bubbler cap plate column in which these formulæ have been checked, using mixtures of known composition. Graphs, obtained from test distillations in the same apparatus using mixtures of petroleum distillates, are given. A method is suggested for determining the proper balance between the heat consumption, column efficiency and the sharpness of the cut when designing fractionating columns. S. F. B.

Kaluga-Black Sea Oil.—*Russ. Oil Bull.*, p. 17, Aug. 15, 1924.

Engineer A. G. Popitch has invented a method of refining Kaluga oil, which may be an object of serious interest to the community of oil producers. The method of refining Kaluga oil by this method gave not less than 50 per cent. distillate of lubricating oils, S. G. 0·918, temperature 150° C., and viscosity 5 at 50°. Further distillation of the mixture with superheated steam showed the possibility of extracting lubricating oils from Kaluga oil. The by-products received are in themselves of value, and may serve as raw material for further chemical investigation. T. W.

Light Petroleum Oils: Purification of.—F. H. Smith and G. J. Ziser, U.S.P. 1,507,692, Sept. 2, 1924.

Light hydrocarbon distillates for use as motor fuels or lamp oils contain compounds which produce tars, resins, gums and colouring matter. It has been found that by exposing the distillates to heat or light polymerisation of the gum and tar forming constituents takes place, and that after the removal of these polymers the oil exhibits no further tendency to colour or gum formation. Petroleum acids are also formed by this ageing process, and after neutralisation by caustic alkali can be removed, together with the gumming polymers by agitating the oil with a small quantity of acid treated clay. A plant for carrying out the process is also described. F. G P. R.

TREATMENT OF ACID SLUDGE.—W. N. Davis and G. A. Davidson. Assrs. to Standard Oil Co. U.S.P. 1,511,721 of Oct. 14, 1924. (Appl. June 19, 1922.)

Acid sludge, obtained in petroleum refining, is hydrolysed by mixing with water and injecting sufficient steam to raise to hydrolising temperature. Hydrolysis is completed and separation obtained under 50 lb. pressure. T. A. S.

HYDROCARBONS, PARTICULARLY CRUDE PETROLEUM: TREATMENT OF.—W. Dederich. E.P. 191,037 of Dec. 22, 1922.

Crude petroleum or petroleum distillates boiling above 100° C. can be desulphurised by heating to 100—110° C. with metal soaps, such as the fatty acid salts of alkaline earth metals, and heavy metals such as iron. The metal sulphides formed by combination of sulphur from the hydrocarbons and metal from the soaps is precipitated, and the free fatty acids are run off from above the oil. To prevent a state of equilibrium in the reaction occurring, a small quantity of water, or a catalyser in the form of an alkali metal or earth metal, for instance metallic sodium, is added. The addition of metal soaps to non-sulphurous petroleum oils enables these to be distilled at a greater rate, whilst at the same time giving cleaner fractionation than without addition of such soaps. F. G. P. R.

TARS OR OILS—DEHYDRATION AND DISTILLATION OF.—Thermal, Industrial and Chemical Research Co. and D. Rider. E.P. 221,528 of April 10, 1924.

Oils or tars are passed through a pipe coiled within a still containing molten metal maintained at a few degrees above the boiling point of the liquid it is desired to vapourise. One end of the coil opens inside the still above the level of the molten metal, the oil thus flowing in a thin layer over the surface of the metal before leaving the still by a draw-off pipe. Over heating of the oil and formation of coke is avoided, and only the desired fraction is vapourised. F. G. P. R.

REMOVING COLLOIDAL ASPHALT FROM CRUDE PETROLEUM.—R. N. Donaldson and R. McCollum. U.S.P. 1,506,115 of Aug. 26.

The colloidal asphalt is flocculated by treating the crude petroleum with dilute sulphuric acid without sulphonating the aromatic hydrocarbons. The asphalt is then removed by filtration. S. F. B.

CRACKING AND HYDROGENATION.

THE TREATMENT OF MEXICAN ASPHALT AND PARAFFIN WAX BY HEATING UNDER PRESSURE WITH SODIUM FORMATE AND WITH CARBON MONOXIDE AND WATER RESPECTIVELY. H. I. Waterman and F. Kortlandt. *Recueil des Travaux Chimiques des Pays-Bas*, **45**, 249-257, 1924.

The researches of Franz Fischer on hydrogenation with sodium formate and with CO and H_2O respectively were carried out with Mexican asphalt and paraffin wax.

Experiments with sodium formate: The experiments were carried out at 400°-425° in a stationary vertical autoclave of about 250 c.c. capacity. The sodium formate experiments were always compared with cracking experiments. The differences in oil yield between both

experiments were not large. The experiments with carbon monoxide were carried out at 420° C. with paraffin wax. An autoclave was used which could be shaken continuously. Each case was experimented with 300 gr. of paraffin wax at 420° C., either alone (cracking) or with the addition of 35 gr. of water, while carbon monoxide was compressed to 18·5 atmospheres respectively. From the analysis of the gases it appeared that a considerable portion of the carbon monoxide with water must be transformed into carbon dioxide and hydrogen. Nevertheless, practically no hydrogen was consumed.

In these experiments the partial pressure of the carbon monoxide, and therefore of the hydrogen also, was much smaller than in the experiments of Fischer and Schrader, but, if indeed it is the nascent hydrogen that reacts with high velocity, one would have still expected to find considerably less of this hydrogen at the end of an experiment. Besides the properties of the formed oil and gases and the course of the pressure curves would indicate that under the conditions of the experiments carbon monoxide and water does not react to any great extent as a hydrogenating mixture.

The experiments described are not necessarily in conflict with those of Franz Fischer and H. Schrader, for Fischer worked with substances such as brown coal, which contain oxygen, while the products used by W. and K. contain little or no oxygen.

H. I. W.

TRANSFORMATIONS CAUSED BY HEATING MIXTURES OF BROWN COAL AND PARAFFIN WAX IN THE PRESENCE OF HYDROGEN OR CARBON MONOXIDE IN CLOSED VESSELS. H. I. Waterman and F. Kortlandt, *Recueil des Travaux Chimiques des Pays-Bas*, **45**, 258-261, 1924. (Continuation of a previous study, p. 249, preceding abstract.)

In order to obtain constant results the brown coal was placed in a disperse medium, which was liquid at the temperature of the reaction, and it was obvious to use paraffin wax for this purpose.

The brown coal contained 30 per cent. of moisture. This "Lematang" brown coal originated from the Dutch East Indies.

The experiments at 423° showed that hydrogen at low pressures is used up by brown coals; also the mixture of carbon monoxide and water because of the nascent hydrogen formed from it gives the same result; and obviously it has a still stronger action than the molecular hydrogen.

While the course of the pressure curves at the previous experiments with paraffin wax indicated the absence of any hydrogenation, the course of the pressure curves with mixtures of paraffin wax and brown coal is quite different, and the results of the gas analysis, too, indicate vigorous hydrogenation.

H. I. W.

HYDROGENATION WITH A MIXTURE OF CARBON MONOXIDE AND WATER AND WITH MOLECULAR HYDROGEN. H. I. Waterman and F. Kortlandt. *Recueil des Travaux Chimiques des Pays-Bas*, **43**, 691-701, 1924.

The hydrogenation of brown coal at 423° (compare l.c., p. 258, preceding abstract) depends on the constituents in the semi-coke; that the semi-coke is active towards hydrogen from carbon monoxide and water and towards molecular hydrogen, and that the low temperature tar is practically not hydrogenated by a mixture of carbon monoxide and water; this is in agreement with the views of Franz Fischer, who is of opinion

that it is chiefly the non-bitumen like constituents of the brown coal, which are hydrogenated.

Further, it is shown that the semi-coke functions as positive catalyst for the reaction $CO+H_2O \rightarrow CO_2+H_2$.

It is therefore advantageous in technical hydrogenation with carbon monoxide to distil the brown coal first at a low temperature, and then hydrogenate the semi-coke, so obtained, in a liquid disperse medium.

As regards the course of the hydrogenation, so far as is already established, that by treating semi-coke from brown coal both with hydrogen, and with a mixture of carbon monoxide and water, the greater part of the hydrogen enters the complex, while simultaneously we always have to do with the extraction of oxygen with the formation of water and dioxide respectively. H. I. W.

THE PREPARATION OF ACTIVE CARBON FROM ASPHALT AND ANTHRACITE BY THE ACTION OF IODINE. F. Nellensteyn. *Chemisch Weekblad*, 21, 533-536, 1924.

It was proved that strong adsorbing kinds of carbon are formed by the action of iodine. Explanations are given for the low yield at activation of carbon by oxygen and for the increase in activity of active carbon at the action of iodine.

The action of HI on different sulphur containing mineral oils gives the formation of H_2S. H. I. W.

FACTS AND FAKES AMONG CRACKING PROCESSES (PART I.).—R. H. Brownlee. *Chem. Met. Eng.* 31, 737.

An interesting account of the development of cracking, its effect on the petroleum industry, and the consumer of gasoline. The quantity of straight run gasoline from crude oil is not sufficient to meet the demand, and cracking processes during last year accounted for 2,000 million gallons of the total production in the United States. The author discusses shortly the meaning of cracking from a chemical point of view and sums up the patent situation, holding that so far as heat and pressure are concerned there is only one basic process, which was invented long before there was any demand for gasoline. The development of ingenious apparatus for carrying out the process is another matter, and all due credit should be given on that account, but not on account of the process. R. P.

POSSIBILITIES IN THE LOW PRESSURE CRACKING OF LOW GRADE FUEL OIL. —Carl J. von Bibra. *Ref. and Nat. Gas Mfr.*, 3, (10), 13.

The author discusses the theory and principles of cracking bringing into consideration the Nernst Equation, Le Chatelier's theorem and the equilibrium conditions which the cracking process tends to establish.

He suggests a process, to work at atmospheric pressure, thus economising in the cost of plant, for the utilisation of asphalt or heavy residues.

A vertical column of refectory fire-brick is filled with balls of similar material. The column has a vapour outlet at top and a fire-grate at the bottom. Near the top there is a trapped inlet for the balls, which enter the column coated with asphalt, or fuel, at about 150° C. While travelling down the upper part of the column the lighter fractions are distilled, by the hot gases from below, at about 400° C.

As the balls descend they carry the undistilled oil into the cracking zone, which removes all volatile compounds leaving the balls covered

with coke. At this point steam is injected into the column. The steam reacts with some of the coke, forming water gas, and the remainder of the coke on the balls passes into the combustion zone where air is admitted. The air cleans the balls, which are conveyed to the oil bath to gravitate again into the top of the column. R. P.

DISSERTATION ON CRACKING (Part 2).—H. Gault. *Les Matieres Grasses*, 197, 6907.

The author continues his paper on cracking, and in this section summarises the results and conclusions of the work carried out by Silliman, Marchant, H. Vohl, Berthelot, Young, Armstrong and Miller, Vivian B. Lewis, Pring and Fairlie, F. Haber, Worstall and Burwell, Bone and Jordan, Bone and Coward, Hempel, Engler, Egloff, Zanetti, Egloff and Moore, Davidson, Clingaert. R. P.

PREPARATION OF A NICKEL CATALYST AND ITS REDUCING ACTIVITY.—M. Lietz. *J. pr. Chem.*, 1924 (ii.), 108, 52-60.

A nickel catalyst for hydrogenation is prepared as follows :—A 3-5 per cent. solution of nickel sulphate is precipitated at the ordinary temperature with sodium carbonate solution. The precipitate is washed, dried in a vacuum, and reduced for the minimum time necessary in hydrogen at 300°.

Experiments using sodium cinnamate showed that the extent of reduction is proportional to the catalyst used. The rate is increased by shaking, and, as the concentration of the sodium cinnamate present has no effect, it would appear to be determined by the diffusion of hydrogen into the metal. S. F. B.

ART OF TREATING PETROLEUM OILS.—Charles S. Palmer. U.S. P. 1,514.098.

An intermittant process for cracking heavy oils is specified, wherein the oil is heated to cracking temperature in inclined parallel tubes set in a furnace. The tubes fit into headers at each end and are thus connected to two upright tubes, of large diameter, which carry the oil from and to a large horizontal drum, elevated 70 feet above the furnace. A hydrostatic pressure of about two atmospheres will exist in the cracking tubes. From the drum a vapour pipe leads the cracked vapours to a condenser and gas separator. The plant is charged and heating causes a thermo-syphon circulation which is continued until the oil in the system becomes so filled with coke as to make it dangerous or uneconomical to continue. R. P.

PROCESS OF AND APPARATUS FOR CRACKING OR CONVERTING OILS.—Otto. P. Amend. U.S.P. 1,512,263.

The process is applicable for the cracking of any of the higher boiling point petroleum distillates. The oil is heated in a still by means of non-metallic (graphitic carbon) electrical "resistors," preferably of a tubular shape whereby a relatively large area is presented by the inner and outer surfaces, insulated from the body of the still. A high amperage current of low voltage is passed through the "resistors" to maintain the oil at a high temperature, and an inert gas is introduced. A pressure of 50 to 150 lbs. per square inch is maintained in order to force the oil into contact with the heating elements. By this means a high local dissociating heat can be applied to the oil without the necessity of heating the metal of the still from outside. Temperatures used vary from 500° to 750° C. R. P.

PROCESS OF CONVERTING OILS.—Otto. P. Amend. U.S.P. 1,512,264.

The plant is the same as in Pat. No. 1,512,263. There is a distinct advantage in having one or more electric heating elements above the surface of the oil. It is also desirable that one or more of the electrically heated carbon tubes, packed with a porous mass of carbon, should fill a cross section of the vapour. Contrary to expectation, the higher the heat used with carbon "resistors," even up to a white heat, the freer is the condensate from unsaturated hydrocarbons and colouring matter. Cracking in the presence of heated graphitic carbon at red to white heat converts kerosene into low boiling hydrocarbons with practically no loss as gas and carbon. R. P.

MOTOR SPIRITS AND OIL FUELS.

GASOLINE: METHOD OF BLENDING.—T. L. Kerr. U.S.P. 1,503,792 of Aug. 5, 1924.

To overcome the difficulty of stratification when casing head gasoline is mixed with heavier petroleum distillates to form motor fuels, the different components are distilled from separate stills and their vapours united before passing to a common condenser. F. G. P. R.

IMPROVED PROCESS OF PREPARING FUELS COMPRISING ALCOHOL AND LIQUID HYDROCARBON.—Soc. Ricard, Allenet & Cie. E.P. 206,516 of Nov. 5, 1923. Conv. (France) of Nov. 4, 1922.

Mixtures of alcohol and hydrocarbon can be easily dehydrated by treatment with anhydrous or potassium carbonate. When 95·5 per cent. alcohol is mixed with twice its volume of light petrol (Sp. Gr. ·808) the liquids separate into two layers at 20°. After shaking with a small quantity of potassium carbonate the temperature of separation is reduced to 4°, and a further treatment reduces this temperature to -17°. The dehydration is rapid and allows of a continuous operation on the industrial scale. The addition of binding agents such as cyclohexabol ether, benzene or higher alcohols facilitates the reaction and better dehydration is obtained. T. A. S.

IMPROVED MOTOR SPIRIT.—G. Scaravelli. E.P. 206,147 of Oct. 23, 1923.

The fuel consists of methylated spirit 75 pts., kerosene 20 pts., and ether 6 pts. It may be prepared by mixing together 84 litres of 95 per cent spirit, 20 litres of kerosene and 350 grs. of sulphuric acid, the acid being subsequently neutralised by the addition of 1200 grs. of lime. An alternative fuel contains 3 pts. of amyl acetate, or 5 pts. of nacetone in place of the 6 pts. of ether. Castor oil to the extent of 5-10 per cent. may be added as a lubricant. Improved engine efficiency is claimed. T. A. S.

LUBRICATING OILS AND WAXES.

PROCESS FOR LOWERING THE COLD TEST OF LUBRICATING OILS.—J. W. Weir and W. J. Ryan, Junr. U.S.P. 1,509,325.

Lubricating oil stock is diluted with naphtha or other petroleum oil diluent and the product thoroughly mixed with a finely divided wax adherent medium, such as diatomaceous earth, fuller's earth, etc. The

mixture is cooled to 0° F. and passed through a filter press. The lubricating oil is recovered from the filtrate by distillation and the paraffin wax from the filter cake by extraction with a hot solvent.

R. W. L. C.

METHOD OF TREATING PETROLEUM OIL.—James W. Weir. U.S.P. 1,509,326, c.f. U.S.P. 1,509,325 (preceding abstract).

The process is an improvement on that disclosed in U.S.P. 1,509,325 in that the spent comminuted material previously used in decolourising the petroleum oil is employed wholly or in part as the wax adherent medium.

R. W. L. C.

COAL, SHALE, PITCH AND ASPHALT.

WHAT ABOUT OIL SHALE? S. D. Kirkpatrick. *Chem. and Met. Eng.*, October 20, 1924.

The article dealt broadly with the position, past and present, of the oil shale industry in America.

Some of the richest oil shale deposits of America occur in the Western States and are of cretaceous and tertiary age. The Green River formation is cited as being one of the richest deposits. The deposits are rarely of uniform thickness or quality, the oil content varying from 5 to 65 gallons of oil per ton of shale. Thin layers have been found which will give 90 to 100 gallons per ton. The oil-bearing shales of the Green River district are of three types—papery, massive and curly, but graduations of one into the other frequently occur. It is estimated that the oil shale resources of Colorado, Utah and Wyoming contain 14 times as much oil as has been taken from the ground in the entire history of the American Petroleum Industry. The history of the oil shale industry can be divided into five periods as follows:—(1) 1908-1912, that of the prospector; (2) 1913-1915, the geologist; (3) 1916-1918, the land speculator; (4) 1919-1922, the promoter; (5) 1923 the technologist. It may be said that in the first period prospectors first brought oil shale to the public notice. Attempts at retorting were made and for a short time the rock used for ornamental and insulating purposes. In the next period the shale formations were studied and reported on by geologists, and much was done to bring the importance of an oil shale to the Government's notice. This was followed by the inevitable land speculator's activities, which unfortunately did much to retard the growth of an oil shale industry. Large tracts of shale-bearing land were eventually bought up by big oil companies, and at the present day are being held as a reserve for the future. The promotor, with his retort, caused another temporary interest to be taken, but a further set back to the industry was the only result. The technologist has now taken the field, and it is hoped that his research work will eventually put the oil shale industry on a proper basis.

W. H. T.

COAL FROM OIL SHALE.—F. C. Gaisser. Braunstoff, *Chem.*, 1924, **5**, 254.

Oil shales were heated with caustic soda or carbonate under pressure, and the residue treated with mineral acid to remove inorganic material. The residual brown powder contained 2-15 per cent. of ash, and had a calorific value of 6500-7800 cals. A tar yield of 33-45 per cent. was obtained, and 10-27 per cent. of gas similar to good coal gas. The coal contained 3-6-5 per cent. of sulphur, and the tar also had a high sulphur content.

F. G. P. R.

BITUMINOUS OILS OBTAINED FROM THE DISTILLATION OF ABRUZZO BITUMENS. G. Cessettini. *Giorn. chim. ind. applicata*, 1924, **6**, 277.

These oils are reddish-brown in colour with a bluish fluorescence, have an aromatic bituminous odour and burn with a sooty flame. They have a sulphur content of 1·7 per cent. calorific value of 11,000 cals., and a specific gravity of 0·920-0·930. After purification, which is both long and costly, a distillation test gave: boiling, between 80°-150°, 6 per cent.; between 150°-250°, 30 per cent.; from 250° to above 360°, 56 per cent. The heavier portions give characteristic precipitates of icthyol derivatives with mercuric chloride and icthyol-sulphonic acid on treatment with sulphuric acid. S. F. B.

OIL-SHALE TECHNOLOGY IN THE MAKING.—Sidney D. Kirkpatrick. *Chem. and Met. Eng.*, **31**, No. 18. Pp. 688-692, Nov. 3, 1924.

The assistant editor of this Journal contributes an interesting paper upon this subject, promising at the same time to return to and further elaborate some of the sections under which he presents it.

Mining, crushing, retorting, refining and the economic problem of producing the necessary commodity advantageously to consumer and producer are here treated.

(*a*) *Mining.*—After stating that in Scotland more than half the cost of producing refined oil-shale products was accounted for by mining, the writer points out that so far as many American oil-shale deposits are concerned, such as those of the Eastern and Mid-Western States, and the great deposits of the Green River formation in Colorado, Utah and Wyoming, the analogy between coal-mining and oil-shale mining cannot be pressed too closely.

An oil-shale seam may vary from 35 to 50 ft. in depth and lie horizontally or nearly so, and again the shale outcrops are usually high above the "plant" sites. Again, the drainage problem for shale is not a menace. Development costs per ton will be lower for shale from the vastly greater tonnage recoverable per acre of land through the same length of permanent openings. These thick shale beds are less difficult to work because the mechanical problems of loading can be attached to the best advantage; moreover, blasting on a large scale can be used.

The above facts favour the mining of shale; on the other hand, oil-shale from its tough rubbery nature is more difficult to drill.

It is predicted that most of the shales of the Western deposits will be mined by underground methods, and the pillar and chamber system, or a modification of it, in which the pillars are left standing (breast-and-bench method of metal mining). Holes are drilled in the upper parts of the bed and after the lower part is removed by vertical drill holes. The output in the zinc mines of South-West Nussiori by this mode was highly economical compared with the Scottish shale mines in 1919.

In relatively few cases open-cut or quarrying methods will be possible, and this will be economically advantageous. A vertical cross-section of outcrop of the "Mahogany" bed of oil-shale near De Beque, Colorado, shows the possibility of this open-cut method. (Figs. 2 and 3, pp. 689-690.)

(*b*) *Crushing.*—This is a very variable requirement.

Its tough, springy nature makes it more difficult to disintegrate than such material as coal. The heat may make the richer forms of shale pasty, and thus jaw-crushers are often found unsatisfactory. The chief types of equipment adapted to oil-shale include, besides jaw-crushers, gyratories; plain, corrugated or spiked rolls; hammer mill and ring pulverisers; with ball-and-rod mills for finer grinding.

The run-of-mine ore is conveyed to the crushing plant by aerial or inclined trams and dumped into bins above the crushers. These discharge into secondary bins, from which the crushed shale is fed by gravity to the retort or elevated to it by belt-and-bucket conveyors.

(c) *Retorting.*—The scale of operations and the handling of material and products of variable properties and behaviour present many difficulties of an engineering character. This subject will be amplified in further articles. The following basic principles are generally accepted by oil-shale investigators in America.

A. Factors connected with the design and construction of the retorting equipment :—

1. *Capacity and Continuity of Operation.*—In America, in view of the large quantities treated, a high capacity is preferred for the retorting unit. Continuity of operation is obviously advantageous.
2. *Durability of Construction.*—Strong and durable materials are highly desirable. Repairs spell loss of production.
3. *Method of Heat Application.*—This is external, as in a coal retort and internal by introducing steam and some inert gas, or even by combustion of the shale itself. The problem is to apply the heat uniformly throughout the charge.
4. *Mechanical Features.*—Retorts must be simple in construction, with moving parts in the heat zone reduced to a minimum.

B. Factors influencing qauntity and quality of the product obtained :—

1. *Rate and Control of Heating.*—Temperature, pressure *and time* absolutely determine the character of the product. The bituminous material is first formed from the kerosene over a vary narrow temperature range, and is broken down immediately into the hydrocarbons that make the various distillates.
2. *Heat Distribution.*—Every shale particle should be equally heated, under similar conditions (involving finely divided shale particles).
3. *Size of Retorted Shale.*—This is controlled by the previous factor and the greater cost of fine grinding : shale dust is a very serious contamination.
4. *Removal of Vapour from Retort :* and 5. *Cracking.*—The nature of the cracking process by which the vapours are formed from the oil-yielding material in the shales makes it obviously necessary to remove them as rapidly as possible and protect them from the higher temperatures ; that would cause excessive production of fixed gas, as well as other undesirable decomposition products. Large and easy outlets should therefore be provided for the vapours.
6. *Use of Steam.*—This has many advantages. As it enters the retort it cools the hot spent shale, forming water gas and ammonia. It can be carefully controlled to distribute the heat uniformly, and finally prevents excessive decomposition and the formation of undesirable nitrogen and sulphur compounds, hard to eliminate in the refining process.

(d) *Refining Problems.*—As characteristic differences between crude shale oil and crude petroleum, the high proportions of unsaturated hydrocarbons, and also a considerable percentage of nitrogenous bases of the Pyridine and Quinoline type in the former are recorded. This accounts for the fact that, whilst in Scotland shale oils seldom yield over 75 per cent. of refined products, in a "complete petroleum refinery" in

the U.S.A. well over 90, and often as much as 95 per cent., of refined products are obtained.

The olefines, however, yield a gasoline superior in some ways to "straight paraffin" gasoline, though they make the refining more difficult. This gasoline is of higher specific gravity and, weight for weight, will yield 10 to 15 per cent. more energy.

The refining problem is to remove the troublesome diolefine compounds (causing the foul odour and undesirable colour) without serious loss of the olefines.

The removal of colour is alluded to as probably easy to be solved.

In conclusion, a table is given showing the general character of Colorado shale-oils. The ten distillation records are typical analyses selected from over 1500 tests and partial tests in refining made by the Colorado Geological Survey (1921).

The paper concludes with a statement made by this authority which points out that the gasoline and kerosene will be hard to clarify, but will equal or surpass those from well petroleum.

The lubricating oils are superior to those of well oil.

The wax is of superior quality.

Residual tars and coke have not at present been satisfactorily tested as regards their uses and value.

There can be no doubt of the commercial possibilities of the shale-oil industry. It will demand technical skill of a high order.

J. E. M. H.

IMPROVEMENTS RELATING TO THE MANUFACTURE OF FUEL BRIQUETTES. Isidore Brun, E.P. 214,229.

A binding material for use in the manufacture of fuel briquettes can be prepared by granulating a mixture of dehydrated mineral tar, freed from its oils, and crude petroleum pitch. S. F. B.

OIL SHALES: METHOD OF CONCENTRATING.—S. H. Dolbear. U.S.P. 1,510,983 of Oct. 7, 1924.

The organic matter in oil shale has been found to form a cohesive froth with oil, and therefore can be separated from inorganic material by pulverising the shale, mixing with water and a small amount of oil, blowing with air and collecting the froth. A small amount of an electrolyte, such as sulphuric acid, may be added to the water to facilitate deposition of the inorganic materials. F. G. P. R.

ACTIVE CARBON.—K. Rhode. U.S.P. 1,505,496 of Aug. 19.

Carbonaceous material, such as brown coal, peat and so on is impregnated with alkali and heated to 1000° in the absence of air. The material obtained is suitable for gas absorption. S. F. B.

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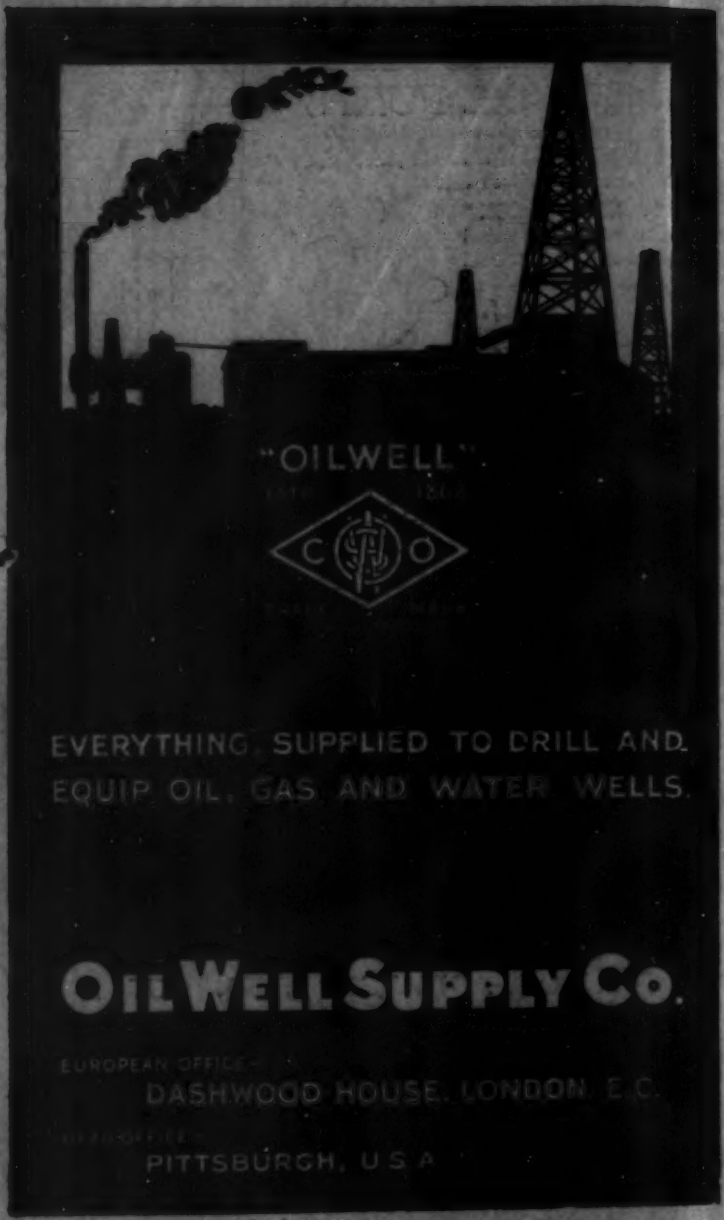
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